

GVTD
D 211.
9:
3827

NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER

Bethesda, Maryland 20034



THE BANDIT COMPUTER PROGRAM FOR THE REDUCTION OF MATRIX BANDWIDTH FOR NASTRAN

Gordon C. Everstine

Approved for public release; distribution unlimited.

COMPUTATION AND MATHEMATICS DEPARTMENT
RESEARCH AND DEVELOPMENT REPORT

20070119043

March 1972

Report 3827

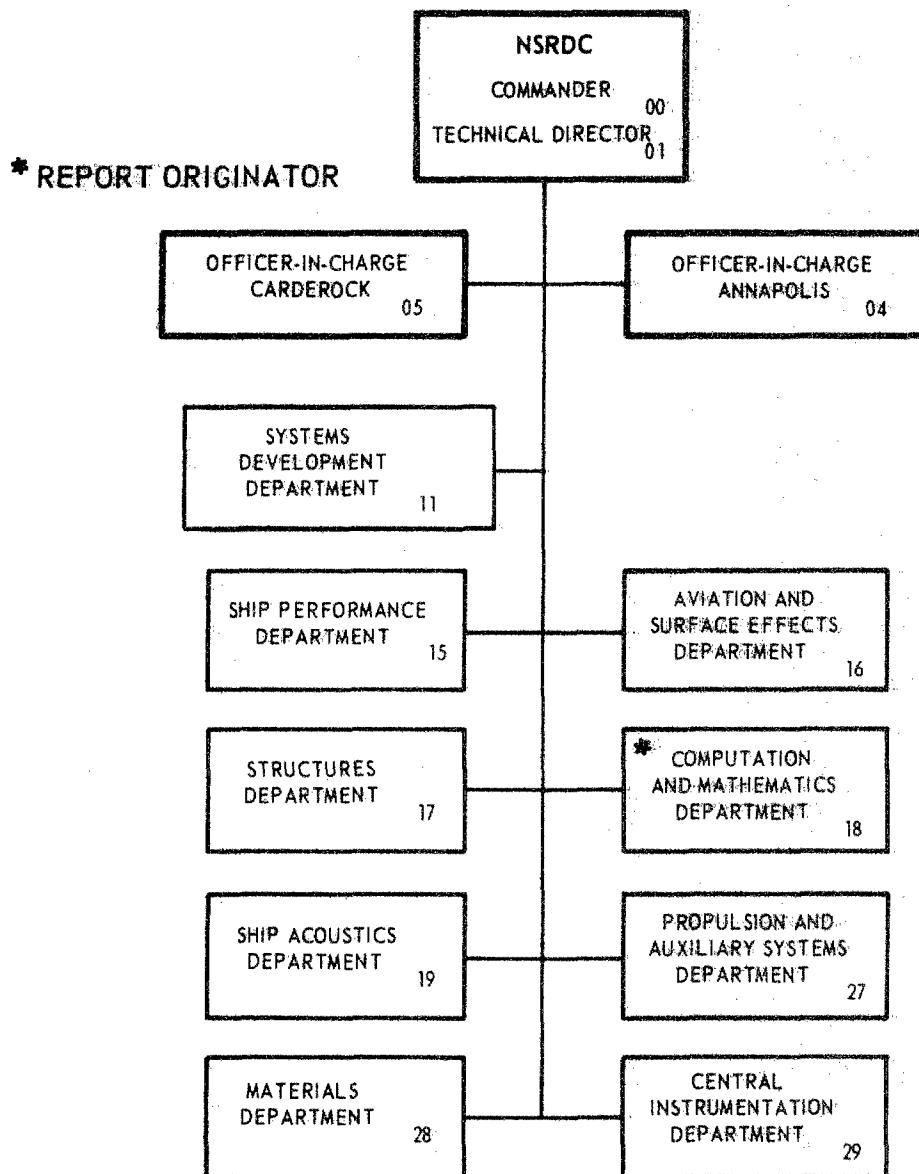
Best Available Copy

THE BANDIT COMPUTER PROGRAM FOR THE REDUCTION OF MATRIX BANDWIDTH FOR NASTRAN

The Naval Ship Research and Development Center is a U. S. Navy center for laboratory effort directed at achieving improved sea and air vehicles. It was formed in March 1967 by merging the David Taylor Model Basin at Carderock, Maryland with the Marine Engineering Laboratory at Annapolis, Maryland.

Naval Ship Research and Development Center
Bethesda, Md. 20034

MAJOR NSRDC ORGANIZATIONAL COMPONENTS



DEPARTMENT OF THE NAVY
NAVAL SHIP RESEARCH AND DEVELOPMENT CENTER
Bethesda, Maryland 20034

THE BANDIT COMPUTER PROGRAM FOR THE
REDUCTION OF MATRIX BANDWIDTH FOR NASTRAN

by

Gordon C. Everstine

Approved for public release; distribution unlimited.

March 1972

Report 3827

TABLE OF CONTENTS

	<u>Page</u>
ABSTRACT.....	1
ADMINISTRATIVE INFORMATION.....	1
I. INTRODUCTION	2
II. USE OF THE BANDIT PROGRAM.....	4
III. THE \$-OPTION CARDS.....	8
IV. PRINTED OUTPUT.....	11
A. Description.....	11
B. Definitions.....	12
V. CORE REQUIREMENTS ON THE CDC COMPUTERS	14
VI. THE RENUMBERING STRATEGY.....	15
VII. DESCRIPTION OF THE CODING.....	18
ACKNOWLEDGMENTS	25
APPENDIX A - Listing of the CDC Version of BANDIT	26
APPENDIX B - Listing of the Machine-Independent Version of BANDIT.....	48

LIST OF TABLES

Table 1 - Connection Cards Recognized by BANDIT	6
Table 2 - Summary of BANDIT \$-Option Cards.....	9

ABSTRACT

This report describes a matrix bandwidth reduction preprocessor for use with the NASA structural analysis computer program, NASTRAN. Called BANDIT, the program is written in FORTRAN and uses the Cuthill-McKee strategy for resequencing grid points. Versions of the program for both CDC and other computers are presented.

ADMINISTRATIVE INFORMATION

The work reported herein was carried out under Task Area ZR 014 02 01.

I. INTRODUCTION

The NASA structural analysis computer program, NASTRAN, is a large general purpose program gaining wide acceptance in the Navy for the solution of both static and dynamic structural problems.

Since NASTRAN uses the finite element displacement method, the structural matrices which are formed are symmetric and sparse. With a suitable choice of the numbers (labels) assigned to the grid points, the matrices are also banded (i.e., the non-zero entries in each matrix are clustered about the main diagonal). For this reason, many of the routines used by NASTRAN for the solution of linear equations and for the extraction of eigenvalues operate most efficiently when the bandwidths of the structural matrices are minimum. Indeed, the number of calculations required in such routines is $O(n b^2)$, where n is the matrix order and b is the matrix bandwidth.

Although it is essential to the NASTRAN user to have matrices with small bandwidth, NASTRAN currently places the burden on the user to number his structure so as to provide such a bandwidth. The inherent difficulties in sequencing nodal labels manually and the increasing use of automatic data generators make this an excessive and unnecessary burden for most structural analysts.

NASTRAN currently allows the user to include in his input data deck a set of cards referred to as SEQGP cards. These cards define a look-up table giving the correspondence between the original grid numbers used in defining the problem and a new set of numbers to be used internally for all calculations.

This report describes a FORTRAN computer program called BANDIT which can be used as a preprocessor to the NASTRAN program to automatically resequence the grid point numbers for reduced bandwidth. Using a standard NASTRAN data deck as input, BANDIT resequences the numbering for reduced bandwidth, if possible, and generates a set of SEQGP punch cards for insertion into the NASTRAN deck.

The renumbering strategy used in BANDIT is that developed by Cuthill and McKee¹. The need to resort to "strategies" becomes evident when one considers that n grid points (or nodes)² can be sequenced in $n!$ distinct ways. Thus, with any strategy, there is no guarantee that an optimum numbering (i. e., one yielding minimum bandwidth) will be achieved. However, of several strategies tested³ to date, the Cuthill-McKee approach¹ appears to be the most consistent for the reduction of matrix bandwidth for the classes of structures of prime interest to the Navy.

The computer program described herein was developed primarily for use on CDC 6400/6600 computers and hence has some machine-dependent features. However, for use on other computers, a machine-independent (and slightly less versatile) version of BANDIT is also described.

1 Cuthill, E. H. and J. M. McKee, "Reducing the Bandwidth of Sparse Symmetric Matrices," Proceedings of the 24th National Conference ACM 1969, pp. 157-172.

2 Throughout this report, "grid point" and "node" are used interchangeably.

3 "Sparse Matrices and Their Applications," Edited by D. J. Rose and R. A. Willoughby, Plenum Press, New York (1972), "Several Strategies for Reducing the Bandwidth of Matrices," (E. H. Cuthill), pp. 157-166.

II. USE OF THE BANDIT PROGRAM

Throughout this and subsequent sections, it is assumed that the reader is familiar with the use of the NASTRAN structural analysis computer program⁴.

BANDIT's primary reason for existence is the generation of the NASTRAN SEQGP data cards to effect low matrix bandwidth. As a by-product, BANDIT can also be used to right-adjust the NASTRAN bulk data. In either case, following the execution of BANDIT, the complete right-adjusted data deck is available on disk file. In addition, the user can elect to have punch card output for either the entire deck or the SEQGP cards alone.

The input data deck for BANDIT consists of a standard NASTRAN data deck (ID card through ENDDATA card, inclusive) with the addition of appropriate BANDIT option cards somewhere before the BEGIN BULK card. These cards, called \$-option cards, indicate to BANDIT the user's choice of options, i.e., what the user wants BANDIT to do. The \$-option cards are listed and described in detail in the next section.

On CDC machines, BANDIT functions as a variable-core program. Hence it is essentially open-ended with respect to the number of grid points that can be handled. During execution, the system is interrogated to determine the field length (amount of core). The dimensions of key arrays are then set so as to fill the available core. As a result, BANDIT must be executed on CDC machines with 'NOREDUCE.' in effect in order to prevent the automatic reduction of field length after the program is loaded.

4 "The NASTRAN User's Manual," edited by C.W. McCormick, NASA SP-222, September 1970.

BANDIT will load and execute in less than 50000_8^5 words of core. With this field length, typical structures with less than 500 grid points can be handled. For larger structures, more core may be needed, in which case BANDIT so informs the user. It has been our experience, however, that rarely are more than 60000_8 words needed. A more detailed discussion of core requirements appears in Section V.

Although BANDIT will accept an entire NASTRAN deck as input, resequencing requires only the following NASTRAN cards: BEGIN BULK, ENDDATA, and all "connection" cards. In particular, GRID cards are not used by BANDIT. The current list of connection cards which BANDIT recognizes is given in Table 1.

BANDIT will accept data on either short or long field data cards. The only restriction to the data concerns sorting. Since BANDIT does not sort the bulk data deck, each continuation to a connection card must immediately follow the parent card. Normally, however, unless long field cards are being used, each logical connection card consists of only one physical card.

If the user so indicates, BANDIT will process all multi-point constraint (MPC) cards present. While NASTRAN MPC's refer to individual degrees of freedom, BANDIT considers only grid points. Thus, each dependent point appearing in an MPC relation is eliminated from the connection table. Additional connections are also generated between each independent point in the constraint equation and every other point to which the dependent point was previously connected.

5 The subscript "8" in this context means "base 8".

TABLE 1 - CONNECTION CARDS RECOGNIZED BY BANDIT

CBAR	CIS2D4	CQUAD2
CCONEAX	CIS2D8	CQUAD3
CDAMP1	CIS3D8	CROD
CDAMP2	CIS3D20	CSHEAR
CDAMP3	CISH8	CTETRA
CDAMP4	CISH16	CTORDRG
CELAS1	CMASS1	CTRAPRG
CELAS2	CMASS2	CTRBSC
CELAS3	CMASS3	CTRIA1
CELAS4	CMASS4	CTRIA2
CFLUID2	CONM1	CTRIARG
CFLUID3	CONM2	CTRMEM
CFLUID4	CONROD	CTRPLT
CHEXA1	CQDMEM	CTUBE
CHEXA2	CQDPLT	CTWIST
CHTTRI2	CQUAD1	CVISC

It should be emphasized that only in rare cases would it make sense to let BANDIT process MPC's. The main reasons for this are that BANDIT does not consider individual degrees of freedom and, in addition, cannot distinguish one MPC "set" from another. Moreover, the effects of MPC's might be better handled by NASTRAN's active column feature.

The whole question of NASTRAN active columns complicates the bandwidth reduction problem, since there are clearly cases in which certain grid points should be relegated to active columns. An example might be the grid points common to both the fuselage and a wing on an airplane. If the user is able to identify such points, he can indicate them to BANDIT using the \$IGNORE card described in the next section. This BANDIT feature, like the MPC feature, will probably find only occasional use.

Following the successful completion of a BANDIT run, whether resequencing was performed or not, the entire NASTRAN deck is contained on a file called TAPE8 (logical unit 8 on some machines). If resequencing has been performed, this file includes the SEQGP cards generated. These cards are inserted into the bulk data deck before the first card whose mnemonic would alphabetically follow "SEQGP". Thus, for a NASTRAN deck already properly sorted, the block of SEQGP cards will be inserted into its proper place. On machines such as the IBM 360, whose collating sequence is opposite to that on the CDC 6400, modification of the coding is needed for proper placement.

III. THE \$-OPTION CARDS

The input data deck for BANDIT consists of a standard NASTRAN data deck (ID card through ENDDATA card, inclusive) with the addition of appropriate BANDIT option cards somewhere before the BEGIN BULK card. These option cards take the form of NASTRAN comment cards, i.e., a card with a dollar sign (\$) in card column #1.

The BANDIT \$-option cards may appear in any order and any location as long as they precede the BEGIN BULK card. There are two general formats for these cards,

\$KEYWORD1 KEYWORD2

or

\$KEYWORD1 N1 N2 N3 ... ,

where the Ni's are positive integers separated by one or more blanks. In order to qualify as a NASTRAN comment card, the \$ must appear in card column #1.

Additional restrictions on the \$-option cards are as follows:

- (1) **KEYWORD1** must start in card column #2.
- (2) There may be no imbedded blanks in either keyword.
- (3) Keywords (or integers) must be separated by one or more blanks.
- (4) At least the first two letters of each keyword are required for proper identification.

A complete list of the \$-option cards, along with a summary of the use of each card, appears in Table 2. In the absence of any card listed, the underlined option is chosen by default.

TABLE 2 - SUMMARY OF BANDIT \$-OPTION CARDS

(Underline denotes default; only the first two letters of each keyword are required)

\$SEQUENCE	<u>NO</u>	Resequencing not desired
	YES	Resequencing is desired
\$RIGHTADJUST	<u>NO</u>	No right-adjusting desired
	YES	Bulk data is to be right-adjusted
\$PUNCH	NONE	No punch output desired
	<u>SEQGP</u>	Only SEQGP cards are to be punched
	ALL	The entire NASTRAN deck is to be punched
\$GRID	N1	The integer N1 is an upper bound on the number of grid points. (The default limits the maximum nodal degree to approximately 19.)
\$PRINT	<u>MIN</u>	Basic printed output
	MAX	Extensive printed output
\$MPC	<u>NO</u>	MPC cards are not to be processed
	YES	MPC cards are to be processed
\$IGNORE	N1 N2 N3 ...	Grid numbers Ni appearing here are ignored during resequencing

The **\$SEQUENCE** card is required to resequence the grid point labels and generate the **SEQGP** cards. For resequencing purposes, the only other data cards required are **BEGIN BULK**, **ENDDATA**, and all connection cards.

The right-adjusting of the bulk data is performed automatically if resequencing (**\$SEQUENCE YES**) is elected. The user can then elect to have this deck punched by using **\$PUNCH ALL**. In any case, it can be accessed on **TAPE8**.

The standard printed output consists of a title page, a listing of the **SEQGP** cards generated (if resequencing is requested), and a user summary. Use of the **\$PRINT MAX** card results in the printing of additional tables as well as information on the flow of calculations during the actual resequencing. However, because of the additional work involved in generating several of the tables, the user pays a penalty in the form of increased execution time. A detailed explanation of **BANDIT** output appears in the next section.

Use of the **\$MPC YES** card results in the processing of all **MPC** cards in the **NASTRAN** deck, regardless of their identifying set numbers. During processing, all dependent grid points on all **MPC** cards will be eliminated from the connection table after the additional connections due to the constraint relations are accounted for. For this reason, the user would normally decline to use this feature.

Although **BANDIT** is a variable-core program, the specific way in which the available core is partitioned depends on both the number of grid points and the maximum nodal degree. Nodal degree is defined in Section IV.B. Based on the space available, **BANDIT** computes default values for the dimensions of various arrays. This partitioning can be

optimized for larger problems by declaring to **BANDIT** the number of grid points present. The appropriate \$-option card is **\$GRID N1**. Here, **N1** is an upper bound (preferably least upper bound) on the number of grid points. In the absence of this card, the default values computed by **BANDIT** result in a limit of approximately 19 on the maximum nodal degree.

The **\$IGNORE** card (Table 2) can be used to designate those grid points **Ni** which should be ignored completely by **BANDIT** during resequencing. This normally results (in **NASTRAN**) in those points being placed into active columns. Any number of **\$IGNORE** cards may appear, although the total number of ignored points may not exceed 100. Ignored points are renumbered last by the **SEQGP** cards.

IV. PRINTED OUTPUT

A. DESCRIPTION

There are two levels of **BANDIT** printed output: maximum printing (obtained by using the **\$PRINT MAX** card), or minimum printing (obtained by default or by using **\$PRINT MIN**). The latter is a subset of the former.

If resequencing is elected, the basic (minimum) output consists of a listing of the **SEQGP** cards generated and a user summary. The user summary contains the following information:

- (1) original matrix semi-bandwidth
- (2) new matrix semi-bandwidth
- (3) central processor (CP) time in **BANDIT**, in seconds

- (4) original matrix profile
- (5) new matrix profile
- (6) number of grid points
- (7) number of elements
- (8) number of components
- (9) maximum nodal degree
- (10) number of points of zero degree
- (11) punch output requested
- (12) field length (FL), octal
- (13) the FORTRAN variables MAXGRD, MAXDEG, & KORE
(defined below)
- (14) date and time

In the "machine-independent" version of BANDIT (Appendix B), items 3 and 14 and KORE are omitted, since the determination of these quantities involves machine-dependent coding.

B. DEFINITIONS

For a matrix A, we follow the notation of Cuthill⁶ and define θ_i as the difference between i and the column index of the first non-zero element of row i of A. Then the semi-bandwidth B is given by

$$B = \max_i \theta_i \quad (1)$$

This value is listed in 1 and 2 above. We note that the relationship between B and the "NASTRAN bandwidth" B_N is

$$B_N = (B+1)k, \quad (2)$$

⁶ Cuthill, E.C., op. cit.

where k is the average number of degrees-of-freedom per grid point. This formula assumes zero NASTRAN active columns.

The profile P of the matrix A is defined as

$$P = \sum_{i=1}^N \theta_i \quad (3)$$

where N is the matrix order. These values are listed in 4 and 5 of the user summary. They provide some measure of the space which would be required to store the matrix A if profile storage were employed instead of band storage. Since NASTRAN does make use of active columns in its routines, the matrix profile may be of interest to some users.

The number of grid points counted by BANDIT (and listed in the user summary) includes only those points appearing on recognizable elements (Table 1). The NASTRAN GRID cards are not processed.

The number of components of a structure is the number of independent substructures, each of which has no connections with grid points of any other substructure. In the event MPC's are processed, each dependent point is eliminated from the connection table and hence becomes its own component.

The degree of a grid point (node) is defined as the number of other grid points to which it is connected. The user summary lists both the maximum nodal degree and the number of grid points of zero degree.

The variables MAXGRD and MAXDEG are the upper bounds on the number of grid points and maximum nodal degree, respectively, for a given BANDIT run. The variable KORE (given in both octal and decimal) refers to the length of blank common in words. It is included in the summary to aid the user in determining his core requirements for very large structures. (See Section V.)

If the user elects maximum printing, the printed output also includes an internal/external grid point correspondence table, three connection tables, and a set of informational messages concerning the renumbering strategy.

The correspondence table lists, for each internal number, the original grid number to which it corresponds. These internal numbers are simply the integers 1 to N for a structure containing N grid points.

The three connection tables supply connectivity information in terms of internal numbers, original grid point numbers, and renumbered numbers (new numbers assigned by the SEQGP cards). For each node label i , the connection table lists its component index, the "distance" from the first non-zero entry in row i (of the matrix) to the diagonal (θ_i), the degree of node i , and the labels of the adjacent nodes.

V. CORE REQUIREMENTS ON THE CDC COMPUTERS

For a given structure, the core requirements depend on two parameters: the number of grid points NN, and the maximum nodal degree MM.

It is not intended that the user should normally have to calculate the required core in order to use BANDIT. A field length of about 55000₈ words should be sufficient for most structures. However, to cover situations in which either NN or MM is unusually large, the user can estimate his core requirements using the algorithm briefly described here.

The length of blank common storage during any given run is denoted KORE. This space is partitioned among several arrays whose dimensions are given in terms of the variables MAXGRD and MAXDEG, which are upper bounds on NN and MM, respectively. The approximate relationship between these variables is

$$KORE = (MAXGRD/K+3)*MAXDEG + 8*MAXGRD, \quad (4)$$

where K, the number of integers packed per word, is given by

$$K = \begin{cases} 6 & , \text{ MAXGRD} < 510 \\ 4 & , \text{ MAXGRD} > 2045 \\ 5 & , \text{ otherwise.} \end{cases} \quad (5)$$

In the absence of a \$GRID card in the NASTRAN deck, BANDIT assigns default values to MAXGRD and MAXDEG such that MAXDEG is approximately 19. Thus, whenever the user anticipates a maximum nodal degree MM greater than 19, he must make use of the \$GRID card.

Using Equation (4), structures for which $KORE < 8500_{10}$ can be run in a field length (FL) of 55000_8 words. Thus, for larger values of KORE, the user need only increase the FL accordingly.

VI. THE RENUMBERING STRATEGY

Although most of the FORTRAN coding in BANDIT is devoted to the task of developing the connection table, the heart of the program is the strategy used for renumbering. BANDIT uses the bandwidth-reduction

approach developed by E. H. Cuthill and J. M. McKee⁷. The resequencing subroutines were written during their early research in this area. Here, for completeness, we present a brief summary of the main ideas of the strategy. A complete discussion, including comparison with other methods, appears in the Cuthill-McKee paper.⁷ A recent survey article by Cuthill⁸ compares algorithms developed for reducing matrix bandwidth, wavefront, or profile. Extensive bibliographies appear in both these papers and hence need not be cited here.

For the purposes of this discussion, a starting node (or grid point) is one given the new label 1. The Cuthill-McKee method⁷ is direct rather than iterative. It involves first the selection of one or more possible starting nodes. Although these nodes are normally of low degree, the one eventually chosen to be the starting node need not be of minimum degree.

For each possible starting node, the remaining nodes are relabeled according to the following prescription: The nodes adjacent to the starting node are labeled in sequence in the order of their increasing degree. In the terminology of graph theory, these nodes are said to be at the first level. Next, for each node of level 1 and in sequence, the numbering continues with those nodes as yet unnumbered and adjacent, in the order of their increasing degree. The set of all nodes (other than 1) adjacent to level 1 nodes thus constitute level 2. The numbering continues in this fashion, level-by-level, until all nodes have been numbered. If several nodes could receive a given label, the first node to qualify is chosen.

⁷ Cuthill, E. H. and J. M. McKee, op. cit.

⁸ Cuthill, E. H., op. cit.

This procedure is carried out for each possible starting node previously selected. The sequence yielding the lowest bandwidth is finally chosen.

It is apparent that, in the absence of ties for a given label, the relabeling sequence is independent of the original numbering once a starting node has been selected. Thus the original nodal numbering has almost no effect on the final numbering.

A secondary criterion used by BANDIT in the renumbering is the matrix profile P . (The definitions of P and the semi-bandwidth B were given in Section IV.) The BANDIT criterion is that, of those nodal numberings which yield the lowest B , the one resulting in the lowest P is chosen. This often has a beneficial effect because NASTRAN uses active columns in matrix factoring.

Accordingly, all nodes of zero degree are numbered last. A node of zero degree occurs in BANDIT either when selected directly by the user (on \$IGNORE cards) or from MPC equations, in which case the dependent nodes are "eliminated" and thus given zero degree.

A final attempt at reducing the profile still further is made by reversing the previous best numbering; i.e., the nodes labeled $1, 2, \dots, n$ are relabeled $n, n-1, \dots, 1$. As pointed out by George⁹, this frequently results in a lower profile P .

⁹ George, J. A., "Computer Implementation of the Finite Element Method," Ph.D. Thesis, Computer Science Department, Stanford University, 1971.

VII. DESCRIPTION OF THE CODING

The CDC 6400/6600 version of BANDIT consists of a main program, 20 FORTRAN subroutines, six FORTRAN functions, and two routines written in the COMPASS assembly language. The complete program listing is given in Appendix A.

A second version of BANDIT, listed in Appendix B, is essentially the same as the CDC version except that all aspects of the program which are unique to the CDC machines have been deleted. For example, the COMPASS routines, upon which the integer packing and variable-core features depend, and all timing routines have been removed. Thus, this version is slightly less general than the CDC version. On the other hand, the integer packing is less necessary on IBM and Univac machines whose word length is shorter than the 60-bit word length on CDC.

In this brief description of the coding for CDC machines, the differences between the two BANDIT versions are indicated, where appropriate.

The main program, called BANDIT in the CDC version, handles preliminary chores and controls some of the output printing and punching. CORSIZ is called to determine the amount of core available for blank common. GOOGAN is called to learn the user's choice of \$-options and, if necessary, to right-adjust the NASTRAN bulk data deck. The partitioning of blank common is accomplished by a call from GOOGAN to GRID. BANDIT then calls NASNUM, which controls the complete processing of the NASTRAN deck as directed by the \$-options chosen by the user. BANDIT's final duty is to control the listing of the NASTRAN deck, the punching of cards, and the printing of the user summary. BANDIT output was described in Section IV.

Subroutine NASNUM is the executive for the formal processing of the NASTRAN deck and is executed in its entirety only if resequencing is requested. NASNUM first reads the deck and forms the connection table IG. A temporary set of node numbers (denoted Set B) is first assigned in the order in which grid points are encountered. The user's original grid numbers constitute Set A. After all cards have been read, a permanent set of internal numbers (Set C) is assigned such that the user's original grid point numbers are arranged in ascending numerical order. If elected by the user, the connection table IG is then updated by subroutine TIGER to reflect the presence of MPC equations. Here, the new connections caused by MPC's are generated and the list of dependent grid points is saved. Then, with subroutine MORRIS, all dependent nodes and others chosen by the user on \$IGNORE cards are deleted from IG. With the connection table IG now complete, the actual renumbering is performed by SCHEME, which generates a correspondence table between the Set C numbers and a new set of nodal numbers, Set D. The correspondence between the user's original numbers (Set A) and the new nodal numbers (Set D) appears on the SEQGP cards listed.

Subroutine FLIP converts an array of original grid point numbers to the internal numbers used by BANDIT. Only unique non-zero integers are retained in the list.

Subroutine GOOGAN reads a NASTRAN data deck (ID card through ENDDATA card, inclusive) and right-adjusts all bulk data. It optionally converts all cards with 8-column field widths to 16-column widths. It is used here to filter a data deck so as to retain only those cards associated with the structure geometry. Finally, it reads the user's \$-option cards and sets the appropriate parameters.

Subroutine **GRID** sets up the dimensions of all those arrays whose lengths depend on either the number of grid points or the maximum nodal degree. The upper bounds on these two quantities are stored in **MAXGRD** and **MAXDEG**, respectively. Since the entries in the connection table **IG** are packed with either four, five, or six integers per word, the packing density is also determined here.

Subroutine **READIT** is called by **GOOGAN** whenever a \$ card containing integer data is encountered. This routine interprets and stores in **IP** all positive integers on the data card. The variable **NIP** contains the number of integers stored in **IP**. **A(I)** contains the alphabetic representation of the character in card column **I**.

Subroutine **BOMBIT** is called whenever a fatal error is detected. This routine writes an appropriate error message onto both the output file, if necessary, and the **CDC** dayfile. The job is then aborted in order to suppress the execution of **NASTRAN** following that of **BANDIT**.

Subroutine **SCAT** is called once for each grid point appearing on a connection card. The routine supplies a fast way of determining for a grid point whether that point has been encountered before and, if so, which temporary internal number has been assigned to it. This is accomplished with the array **INV(I, J)**, where **INV(I, 1)** contains an original grid number and **INV(I, 2)** contains the internal number assigned to it. The location **I** chosen for grid point **N** is given by

$$I = \text{MOD} (N-1, \text{KMOD}) + 1 . \quad (6)$$

If that location has previously been selected for some other point, the first available location following **I** is used instead. The row dimension of **INV** is approximately $2 \cdot \text{MAXGRD}$, where **MAXGRD** is the upper bound on the number of grid points.

Subroutine **BRIGIT** is called after all connection cards have been read and the connection table is complete. Prior to the call, the internal numbers were assigned to the original grid numbers in order of their occurrence. **BRIGIT** performs a sort of the original numbers, assigns new sequential internal numbers, and converts the connection table **IG** and the array **NORIG** to the new set of internal numbers. Here, **NORIG(I)** contains the original grid point number corresponding to the internal number **I**.

Subroutine **SORT** sorts a list of length **NL**. The routine operates fastest on those lists not badly out of order.

Subroutine **SETIG** makes additions to the connection table **IG**. For example, if **KG1** and **KG2** are two connected grid points, this routine sets **IG(KG1, J) = KG2** and **IG(KG2, K) = KG1**, for some **J** and **K**, if this connection has not already been set.

Subroutine **TIGER** makes additions to the connection table **IG** required by the presence of **MPC**'s. The dependent grid points (those appearing first in each equation) are stored in array **LIST** for later removal from **IG**. This routine is called by **NASNUM** and executed only if the user elects to take the **MPC**'s into account by inserting the card **\$MPC YES** into the **NASTRAN** deck.

Subroutine **SWITCH** generates a new connection table **IG** according to a correspondence table **KT** which is set up prior to the call. Here **KT(I)** contains the new designation to be assigned to the grid number currently labeled **I**, i. e., **KT(old) = new**.

Subroutine **MORRIS** deletes all reference in the connection table **IG** to those points stored in an array **LIST** of length **NL**.

Subroutine **FIXIT** compresses out zeroes and multiple entries in an array **LIST** originally of length **NL**. A corrected length **NL** is returned

to the calling program.

Subroutine **SCHEME** is the executive for the actual renumbering strategy. The principal quantities required before the call are the number of nodes **NN**, an upper bound **MM** on the maximum nodal degree, and the connection table **IG**. **IG** is an **NN** x **MM** matrix such that a typical element **IG(I,J)** contains the label of the J^{th} node adjacent to node **I**. The node labels referred to here are the permanent (sorted) set of internal numbers assigned by **BANDIT**.

SCHEME first determines the degree of each node, the most prevalent nodal degree, the number of components, the maximum nodal degree, and the original bandwidth. Then, for each component, a list of starting nodes is supplied by **DIAM** followed by a resequencing by **RELABL** for each starting node. The numbering sequence yielding the lowest bandwidth and profile is eventually chosen as the new numbering sequence. The output from **SCHEME** includes an array **ILD**, where **ILD(I)** contains the new label corresponding to the original internal label **I**.

Subroutine **STACK** is called by **SCHEME** after the basic renumbering has been completed. This routine determines all points of zero degree and places them last in the numbering sequence.

Subroutine **REVERS** reverses the numbering of the first **NN-KT** grid points, where **NN** is the total number of grid points and **KT** is the number of points of zero degree. The variable **KT** is set in subroutine **STACK** prior to any calls to **REVERS**.

Subroutine **DEGREE** sets up the **IDEG** array containing in location **I** the degree of node **I**.

Function **MODE** has as its value the most prevalent nodal degree. If several degrees are equally prevalent, the lowest is chosen.

Function **COMPNT** has as its value the number of components stored in the array **IG**. This function also sets up arrays **IC**, in which the I^{th} element contains a component index for the node labeled **I**, and **ICC**, in which the I^{th} element contains an index indicating the starting position to be used for labels for component **I**. Thus, the number of elements in component **I** is given by

$$\text{ICC}(\text{I} + 1) - \text{ICC}(\text{I}) .$$

Function **MAXDGR** has as its value the maximum degree of any node of component $\text{NC} > 0$. If the formal parameter $\text{NC} \leq 0$, all components are considered.

Function **MAXBND** has as its value the maximum difference between node labels of connected nodes for nodes of component $\text{NC} > 0$. If the parameter $\text{NC} \leq 0$, all components are considered and hence the bandwidth is computed. This routine also computes **IH**, the matrix profile.

Function **MINDEG** has as its value the minimum degree of any node of component $\text{NC} > 0$. If $\text{NC} \leq 0$, all components are considered.

Subroutine **DIAM** determines **NL** starting nodes and stores the list in the array **NODESL**.

Subroutine **RELABL** generates a relabeling scheme starting with **NS** nodes whose labels are stored in the array **NODES**. Although this routine allows for multiple starting nodes, **BANDIT** currently considers only one starting node at a time (corresponding to $\text{NS} = 1$). The relabeling permutation developed by **RELABL** is stored in **ILD** and **NEW**. **ILD(I)** contains the new label for the node labeled **I** in the original numbering scheme. The **NEW** array is the inverse of **ILD**.

Function **IDIST** has as its value the maximum distance of any node in component **IC(NS)** from the node **NS**. The distance of each node in

this component is stored in the array IDIS. The maximum number of nodes at the same distance from NS is stored in ML.

The COMPASS routine PCUP has three entry points used by BANDIT: PACK, IUNPK, and ABT. The first two are for integer packing and unpacking, respectively. Since most of the BANDIT variables are integer, the CDC 60-bit word length is wasteful of available core. Thus, to reduce the overall core requirements, the connection table IG is packed with four, five, or six integers per word. For example, instead of the FORTRAN statement

$$IG(I, J) = L, \quad (7)$$

we have

$$CALL PACK(IG, MAXGRD*(J-1)+I, NBITIN, L). \quad (8)$$

Similarly, instead of

$$M = IG(I, J), \quad (9)$$

we have

$$M = IUNPK(IG, MAXGRD*(J-1)+I, NBITIN). \quad (10)$$

Here, the first three arguments refer to the function name, the location, and the number of bits per integer, respectively, and MAXGRD is the row-dimension of IG. Statements of these types appear throughout the coding of the CDC version of BANDIT.

Subroutine ABT causes an abnormal termination of BANDIT.

The other COMPASS routine, CORSIZ, provides BANDIT with its variable-core feature by interrogating the system during execution to determine the field length (FL) and the distance from the first word of blank common to the end of the FL. These values are returned to the calling program through common block /K/.

The BANDIT listing in Appendix B was prepared for machines other than CDC machines and omits the routines written in the COMPASS assembly language. Hence this version of BANDIT has no integer packing and is a fixed-core program. Additional changes were made in BANDIT, NASNUM, GRID, and BOMBIT and given new end-punching (JJ).

The following disk files are used by this version of BANDIT: TAPE5 (input), TAPE6 (output), TAPE7 (punch), TAPE9 (scratch), TAPE11 (scratch), and TAPE8. The latter is a BCD file which, after a successful BANDIT run, contains the complete NASTRAN data deck.

The Appendix B version of BANDIT could easily be converted into a variable-core program for any machine for which an assembly language routine could be written to determine the length of blank common storage.

ACKNOWLEDGMENTS

The author wishes to thank Dr. E.H. Cuthill and James M. McKee for ideas resulting from many interesting and stimulating discussions and for the following research subroutines which have been incorporated into BANDIT: SCHEME, DEGREE, COMPNT, MAXDGR, MAXBND, MINDEG, DIAM, RELABL, and IDIST. Appreciation is also expressed to Michael E. Golden for the assembly language routines which he developed.

APPENDIX A LISTING OF THE CDC VERSION OF BANDIT

```

PROGRAM BANDIT(INPUT=601,OUTPUT=601,PUNCH=161,INSERT=161,
1 TAPE5=INPUT,TAPE6=OUTPUT,TAPE7=PUNCH,TAPE12=INSERT,
2 TAPE8=801,TAPE9=801,TAPE11=161)
C
C      B A N D I T
C
C MAIN PROGRAM FOR THE RENUMBERING OF NASTRAN GRID POINTS FOR
C REDUCED BANDWIDTH.
C THE NASTRAN DATA DECK MUST CONTAIN A BEGIN BULK CARD IN ITS
C PROPER PLACE AND TERMINATE WITH AN ENDDATA CARD.
C
C DIMENSION A(20)
COMMON KOM(1000)
COMMON /S/ NN,MM,IH,IB
COMMON /P/ IH0,IHE
COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC
COMMON /B/ IPARAM(20),IARG(5)
COMMON /C/ IWARN,LINE,KORIG,KNEW
COMMON /K/ II(7),KORE,IFL
COMMON /BITS/ NBITIN,NBITEX,IPASS
COMMON /TIME/ STIME,NCOMP
COMMON /NEL/ NEL,TIM2
COMMON /DOL/ ISTART(100),IGNORE(100),IFIRST(100)
COMMON /DOLL/ IDIM,ISTA,IIG,IFIR,IGDEG,ISCH
COMMON /ZERO/ KT
COMMON /NG/ NGRID,CLOCK
INTEGER EOF
DATA BEGI,ENDD,SEQG/4HREGI,4HENDD,4HSEQG/
CALL SECOND(TIM1)
CALL REMARK(40H== N A S T R A N -- B A N D I T ==)
CALL DATE(DAY)
CALL TIME(CLOCK)
C DETERMINE KORE, THE DIMENSION OF THE KOM ARRAY, AND IFL, THE FL.
CALL CORSIZ
C SET NGRID DEFAULT.
NGRID=KORE/12
IF(NGRID.GT.2045) NGRID=KORE/13
C SET SCHEME DEFAULTS.
IARG(1)=80
IARG(2)=1
IARG(3)=2
IARG(4)=2
IARG(5)=0
C SET NUMBER OF BITS PER WORD FOR INTERNAL AND EXTERNAL
C GRID NUMBERS.
NBITIN=12
NBITEX=60
7 FORMAT(1H1,16(/),
1 36X,57HBBBBBB AAAAA N N 000000 IIIIII TTTTTT/BANDIT49
2 36X,57HB B A A NN N D D I T /BANDIT50
3 36X,57H B A A N N N D D I T /BANDIT51
4 36X,57HBBBBBB A A N N N D D I T /BANDIT52
5 36X,57H B AAAAAA N N N D D I T /BANDIT53
6 36X,57H B A A N NN D D I T /BANDIT54
7 36X,57HBBBBBB A A N N 000000 IIIIII T )BANDIT55
8 FORMAT(22(/),48X,34HTHEORY OF STRUCTURES BRANCH (1844) /
1 46X,38HCOMPUTATION AND MATHEMATICS DEPARTMENT /
2 44X,42HNAVAL SHIP RESEARCH AND DEVELOPMENT CENTER /
3 53X,24HBFTHESDA, MARYLAND 20034 )
9 FORMAT(/61X,8HCDC 6700/57X,
+ 16HREV. 10 MAR 1972 )
10 FORMAT(20A4)
11 FORMAT(1H ,20A4)
12 FORMAT(1H1)
13 FORMAT(///26H TOTAL CP TIME IN BANDIT = ,F9.3,6H SEC.)
LINE=55
KNEW=0
REWIND 8
C PRINT TITLE PAGE.
WRITE(6,7)
WRITE(6,8)
WRITE(6,9)
C INITIALIZE VARIABLES.
DO 15 J=1,20
15 IPARAM(J)=0
IPARAM(12)=4
IDIM=100
ISTA=0
IIG=0
ISCH=0
IFIR=0
IGDEG=0
DO 18 I=1,IDIM
ISTART(I)=0
IFIRST(I)=0
18 IGNORE(I)=0
IPASS=0
NN=0
MM=0
MAXGRD=0
MAXDEG=0
KMOD=0
KORIG=0
KNEW=0
STIME=0.
NCOMP=0
NEL=0
KT=0
TIM2=0.
REWIND 9
C READ DECK FOR FIRST TIME.

```

CALL GOOGAN(1,2,5,9)	BANDI102	101
C SLICE UP CORE ACCORDING TO SUBROUTINE GRID.	BANDI103	102
K2=II(1)*II(2)+1	BANDI104	103
K3=K2+II(3)*2	BANDI105	104
K4=K3+II(4)	BANDI106	105
K5=K4+II(5)	BANDI107	106
K6=K5+II(6)	BANDI108	107
K7=K6+II(7)	BANDI109	108
C PROCESS DECK.	BANDI110	109
CALL NASNUM(KOM(1),II(1),KOM(K2),II(3),KOM(K3),KOM(K4),KOM(K5),	BANDI111	110
+KOM(K6),KOM(K7),KOM(1),KOM(K2))	BANDI112	111
C ARRAY STARTING AT LOCATION K7 HAS DIMENSION 2*MAXDEG	BANDI113	112
C PROCESS OUTPUT ACCORDING TO OUTPUT REQUESTS.	BANDI114	113
C CHECK IF CONNECTION CARDS IN DECK.	BANDI115	114
IF(IPARAM(9).EQ.3)GO TO 19	BANDI116	115
REWIND 8	BANDI117	116
REWIND 9	BANDI118	117
FLAG=ENDD	BANDI119	118
J=0	BANDI120	119
K=9	BANDI121	120
GO TO 20	BANDI122	121
19 REWIND 8	BANDI123	122
J=0	BANDI124	123
K=8	BANDI125	124
FLAG=ENDD	BANDI126	125
IF(IPARAM(5).EQ.4)GO TO 20	BANDI127	126
K=9	BANDI128	127
IF(IPARAM(6).EQ.3)FLAG=REGI	BANDI129	128
20 READ(K,10)A	BANDI130	129
IF(EOF(K).NE.0)CALL BOMBIT(1)	BANDI131	130
J=J+1	BANDI132	131
IF(IPARAM(10).EQ.5.AND.A(1).NE.SEQG) J=J-1	BANDI133	132
IF(MOD(J,LINE).EQ.1)WRITE(6,12)	BANDI134	133
IF(IPARAM(10).EQ.6) WRITE(6,11) A	BANDI135	134
IF(IPARAM(10).EQ.5.AND.A(1).EQ.SEQG) WRITE(6,11) A	BANDI136	135
IF(IPARAM(1).EQ.2)WRITE(7,10)A	BANDI137	136
IF(IPARAM(1).EQ.1.AND.A(1).EQ.SEQG) WRITE(7,10) A	BANDI138	137
IF(K.NE.8) WRITE(8,10) A	BANDI139	138
IF(A(1).NE.FLAG)GO TO 20	BANDI140	139
IF(FLAG.EQ.ENDD)GO TO 25	BANDI141	140
FLAG=ENDD	BANDI142	141
K=5	BANDI143	142
GO TO 20	BANDI144	143
25 CALL SECOND(TIM2)	BANDI145	144
TIM2=TIM2-TIM1	BANDI146	145
IF(IPARAM(5).EQ.3)GO TO 60	BANDI147	146
IF(IPARAM(7).EQ.4)GO TO 60	BANDI148	147
IF(IPARAM(9).EQ.4)GO TO 60	BANDI149	148
C USER SUMMARY.	BANDI150	149
WRITE(6,50) KORIG,KNEW,TIM2	BANDI151	150
50 FORMAT(23H1**BANUIT USER SUMMARY /	BANDI152	151
1 8X,25HORIGINAL SEMI-BANDWIDTH = ,I9/	BANDI153	152
2 8X,20HNEW SEMI-BANDWIDTH = ,I14/	BANDI154	153
3 8X,19HCP TIME IN BANDIT = ,F9.3,6H SEC.)	BANDI155	154
WRITE(6,117) IH0,IHE	BANDI156	155
117 FORMAT(8X,18HORIGINAL PROFILE = ,I16/8X,13HNEW PROFILE = ,I21)	BANDI157	156
WRITE(6,104) NN	BANDI158	157
WRITE(6,113) NEL	BANDI159	158
WRITE(6,112) NCOMP	BANDI160	159
WRITE(6,107) MM	BANDI161	160
107 FORMAT(8X,22HMAXIMUM NODAL DEGREE = ,I12)	BANDI162	161
WRITE(6,116) KT	BANDI163	162
I=IPARAM(1)	BANDI164	163
IF(I.EQ.1) WRITE(6,101)	BANDI165	164
IF(I.EQ.2) WRITE(6,102)	BANDI166	165
IF(I.EQ.3) WRITE(6,103)	BANDI167	166
101 FORMAT(8X,34HPUNCH OUTPUT SEQGP CARDS)	BANDI168	167
102 FORMAT(8X,34HPUNCH OUTPUT ALL CARDS)	BANDI169	168
103 FORMAT(8X,34HPUNCH OUTPUT NONE)	BANDI170	169
WRITE(6,119) IFL	BANDI171	170
WRITE(6,105) MAXGRD,MAXDEG	BANDI172	171
105 FORMAT(18X,8HMAXGRD = ,I11/18X,8HMAXDEG = ,I11)	BANDI173	172
WRITE(6,109) KORE,KORE	BANDI174	173
109 FORMAT(18X,6HKORE = ,I13/18X,6HKORE = ,6X,06,1HB)	BANDI175	174
WRITE(6,111) DAY,CLOCK	BANDI176	175
111 FORMAT(8X,14HDATE AND TIME ,2A10)	BANDI177	176
C IPASS=NUMBER OF PCUP CALLS.	BANDI178	177
104 FORMAT(8X,23HNUMBER OF GRID POINTS = ,I11)	BANDI179	178
113 FORMAT(8X,20HNUMBER OF ELEMENTS = ,I14)	BANDI180	179
112 FORMAT(8X,22HNUMBER OF COMPONENTS = ,I12)	BANDI181	180
116 FORMAT(8X,28H# OF POINTS OF ZERO DEGREE = ,I6)	BANDI182	181
119 FORMAT(8X,19HFIELD LENGTH (FL) = ,8X,06,1HB)	BANDI183	182
GO TO 70	BANDI184	183
60 IF(IPARAM(10).EQ.5) WRITE(6,12)	BANDI185	184
WRITE(6,13) TIM2	BANDI186	185
70 CONTINUE	BANDI187	186
REWIND 8	BANDI188	187
IF(IPARAM(8).EQ.4) STOP 5	BANDI189	188
STOP	BANDI190	189
END	BANDI191	190
SUBROUTINE NASNUM(IG,II1,INV,II3,INT,ICC,ILD,NORIG,IP,JG,JNV)	NASNUM 2	191
DIMENSION A(8),KG(40),LG(40),LINE(10),B(20),ATEMP(4)	NASNUM 3	192
DIMENSION IG(II1,1),INV(II3,2),JG(1),JNV(1)	NASNUM 4	193
DIMENSION INT(1),ICC(1),ILD(1),NORIG(1),IP(1)	NASNUM 5	194
C IP HAS DIMENSION 2*MAXDEG. JG AND JNV ARE EQUIV TO IG AND INV.	NASNUM 6	195
COMMON /S/ NN,MM,TH,IB	NASNUM 7	196
COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC	NASNUM 8	197
COMMON /B/ IPARAM(20),IARG(5)	NASNUM 9	198
COMMON /C/ IWARN,NLINE,KORIG,KNEW	NASNUM10	199
COMMON /BITS/ NBITIN,NBITEX,IPASS	NASNUM11	200

COMMON /K/ II(7),KORE	NASNUM12	201
COMMON /TIME/ TIM2,NGOMP	NASNUM13	202
COMMON /NEL/ NEL	NASNUM14	203
COMMON /JOL/ ISTART(100),IGNORF(100),IFIRST(100)	NASNUM15	204
COMMON /DOLL/ IOIM,ISTA,IIG,IFIR,IGDEG,ISCH	NASNUM16	205
C THE VARIABLE LINE DEFINED NEAR CARD NASNUM,300 IS NOT THE	NASNUM17	206
C SAME AS THE VARIABLE LINE APPEARING IN COMMON	NASNUM18	207
C IN OTHER ROUTINES.	NASNUM19	208
DIMENSION TYPE(50),WYPE(50)	NASNUM20	209
DIMENSION F1A(2),F10A(2),F1B(2),F10B(2)	NASNUM21	210
DATA BEGI,FNO,SEQG/4HREGI,4HENDD,4HSEQG/	NASNUM22	211
DATA TYPE/4HGBAR,4HCELA,4HCELA,4HCONR,4HCQDM,4HCQDP,4HCQUA,	NASNUM23	212
1 4HCQUA,4HCQUA,4HCRDD,4HCSHE,4HCTRB,4HCTRI,4HCTRI,4HCTRM,	NASNUM24	213
2 4HCTRP,4HCTUB,4HCTWI,4HENDD,4HMPG*,4HCDAM,4HCDAM,4HCHAS,	NASNUM25	214
3 4HCHAS,4HCVIS,4HCDAM,4HCDAM,4HCELA,4HCELA,4HCHAS,4HCHAS,	NASNUM26	215
4 4HCON,4HCTOR,4HCTRA,4HCTRI,4HCONM,4HCONM,4HCHTT,4HCIS3,	NASNUM27	216
5 4HCIS3,4HCIS2,4HCIS2,4HCISH,4HCISH,4HCFLU,4HCFLU,4HCFLU,	NASNUM28	217
6 4HCTET,4HCHEX,4HCHEX/	NASNUM29	218
DATA WYPE/4H*,4HS1*,4HS2*,4HOD*,4HEM*,4HLT*,4HD1*,	NASNUM30	219
1 4HOD*,4HD3*,4H*,4HAR*,4HSC*,4HA1*,4HA2*,4HEM*,	NASNUM31	220
2 4HLT*,4HE*,4HST*,4HATA,4H*,4HP1*,4HP2*,4HS1*,	NASNUM32	221
3 4HS2*,4HC*,4HP3*,4HP4*,4HS3*,4HS4*,4HS3*,4HS4*,	NASNUM33	222
4 4HEAX*,4HORG*,4HPRG*,4HARG*,4H1*,4H2*,4HRI2*,4HD8*,	NASNUM34	223
5 4HOD2*,4HD4*,4HDA*,4H8*,4H16*,4HD2*,4HD3*,4HD4*,	NASNUM35	224
6 4HRA*,4HA1*,4HA2*/	NASNUM36	225
NTYPE=50	NASNUM37	226
REWIND 8	NASNUM38	227
REWIND 9	NASNUM39	228
NMPC=40	NASNUM40	229
KMOD=2.*FLOAT(MAXGRD)-2.2715*SQR(1.131*FLOAT(MAXGRD))	NASNUM41	230
NFW=0	NASNUM42	231
IWARN=0	NASNUM43	232
NEQ=0	NASNUM44	233
2 FORMAT(29H1BANDIT INFORMATION MESSAGE -	NASNUM45	234
+19H NO GRID POINTS/	NASNUM46	235
+20H RESEQUENCING SUPPRESSED)	NASNUM47	236
4 FORMAT(19H ***NEW BANDWIDTH =,I6)	NASNUM48	237
5 FORMAT(33H1THE WRONG CARD FOLLOWS THIS CARD/1X,2A4,1P4E16.7,2A4//	NASNUM49	238
2 40H THE CONTINUATION CARD IS REQUIRED NEXT ,	NASNUM50	239
3 36HSINCE BANDIT DOES NOT SORT THE DECK.	NASNUM51	240
4 13H FATAL ERROR.)	NASNUM52	241
6 FORMAT(1H1)	NASNUM53	242
7 FORMAT(54H1 ONE OR MORE SEQGP CARDS ALREADY APPEAR IN DATA DECK./	NASNUM54	243
+ 55H RESEQUENCING CANNOT BE REQUESTED. FATAL ERROR.)	NASNUM55	244
8 FORMAT(5HSEQGP,3X,2I8,56X)	NASNUM56	245
9 FORMAT(20A4)	NASNUM57	246
10 FORMAT(2A4,4F16.0,2A4)	NASNUM58	247
11 FORMAT(1H ,5(I8,I11,7X))	NASNUM59	248
12 FORMAT(5HSFQGP,3X,8I8,8X)	NASNUM60	249
14 FORMAT(///26H ***BANDIT WARNING MESSAGE /	NASNUM61	250
1 11X,35HTHE WRONG CARD MAY FOLLOW THIS CARD /	NASNUM62	251
2 11X,2A4,1P4E16.7,2A4/	NASNUM63	252
3 11X,47HCHECK INPUT DECK TO BE SURE THAT A CONTINUATION ,	NASNUM64	253
4 42H CARD IS NEITHER MISSING NOR OUT OF SORT.)	NASNUM65	254
15 FORMAT(26H TOTAL CP TIME IN SCHEME = ,F9.3,6H SEC.)	NASNUM66	255
19 FORMAT(1H1,5(20HINTERNAL ORIGINAL,6X)/	NASNUM67	256
11H ,5(20HGRID NO. GRID PT.,6X))	NASNUM68	257
C RETURN IF RESEQUENCING IS NOT DESIRED.	NASNUM69	258
IF(IPARAM(5).EQ.3)RETURN	NASNUM70	259
C CHECK IF SEQGP CARDS ALREADY APPEAR IN DECK.	NASNUM71	260
IF(IPARAM(7).EQ.3)GO TO 22	NASNUM72	261
C ABORT BANDIT SINCE SEQGP CARDS ALREADY APPEAR IN DECK.	NASNUM73	262
WRITE(6,7)	NASNUM74	263
CALL BOMBIT(3)	NASNUM75	264
C READ AND EXTRACT CONNECTION CARDS FROM DECK.	NASNUM76	265
22 CALL GOOGAN(2,1,9,8)	NASNUM77	266
REWIND 8	NASNUM78	267
REWIND 9	NASNUM79	268
C INITIALIZE EXPANDABLE CORE.	NASNUM80	269
DO 30 I=1,KORE	NASNUM81	270
30 JG(I)=0	NASNUM82	271
C READ CARD.	NASNUM83	272
40 READ(8,10)F1A,(A(I),I=1,4),F10A	NASNUM84	273
C DETERMINE CARD TYPE.	NASNUM85	274
45 ITYPE=0	NASNUM86	275
DO 50 I=1,NTYPE	NASNUM87	276
50 IF(F1A(1).EQ.TYPE(I).AND.F1A(2).EQ.WYPE(I)) ITYPE=I	NASNUM88	277
IF(ITYPE.EQ.0)GO TO 40	NASNUM89	278
IF(ITYPE.EQ.19)GO TO 500	NASNUM90	279
IF(ITYPE.EQ.20.AND.IPARAM(4).EQ.3)GO TO 40	NASNUM91	280
C READ CONTINUATION TO CARD JUST READ.	NASNUM92	281
READ(8,10)F1B,(A(I),I=5,8),F10B	NASNUM93	282
C CHECK EACH LOGICAL CARD FOR PROPER SORT.	NASNUM94	283
IF(F1B(1).EQ.F10A(1).AND.F1B(2).EQ.F10A(2)) GO TO 60	NASNUM95	284
C--- IF FOLLOWING CARD TYPES ARE OUT OF SORT, NO ERROR	NASNUM96	285
IF(ITYPE.EQ.1.OR.ITYPE.EQ.4)GO TO 56	NASNUM97	286
IF(ITYPE.EQ.32)GO TO 56	NASNUM98	287
IF(ITYPE.EQ.33)GO TO 56	NASNUM99	288
IF(ITYPE.EQ.35)GO TO 56	NASNU100	289
IF(ITYPE.EQ.36)GO TO 56	NASNU101	290
IF(ITYPE.EQ.37)GO TO 56	NASNU102	291
IF(ITYPE.EQ.45.OR.ITYPE.EQ.46) GO TO 56	NASNU103	292
C--- IF FOLLOWING CARD TYPES ARE OUT OF SORT, POSSIBLE ERROR (GIVE	NASNU104	293
C--- WARNING MESSAGE)	NASNU105	294
IWARN=IWARN+1	NASNU106	295
IF(MOD(IWARN,6).EQ.1)WRITE(6,6)	NASNU107	296
IF(ITYPE.EQ. 2) GO TO 54	NASNU108	297
IF(ITYPE.EQ. 3) GO TO 54	NASNU109	298
IF(ITYPE.EQ.10) GO TO 54	NASNU110	299
IF(ITYPE.EQ.17) GO TO 54	NASNU111	300

IF (ITYPE.GE.21.AND.ITYPE.LE.31)GO TO 54	NASNU112	301
C--- FOR OTHER CARD TYPES OUT OF SORT, AROPT BANDIT	NASNU113	302
52 WRITE(6,5)F1A,(A(I),I=1,4),F10A	NASNU114	303
CALL 30MBIT(2)	NASNU115	304
54 WRITE(6,14)F1A,(A(I),I=1,4),F10A	NASNU116	305
C SAVE CONTENTS OF THE SECOND CARD OF THE PAIR.	NASNU117	306
55 DO 56 I=1,4	NASNU118	307
ATEMP(I)=A(I+4)	NASNU119	308
58 A(I+4)=0.	NASNU120	309
C INITIALIZE KG AND LG.	NASNU121	310
60 DO 70 I=1,NMPC	NASNU122	311
KG(I)=0	NASNU123	312
70 LG(I)=0	NASNU124	313
LOOP=1	NASNU125	314
NCON=4	NASNU126	315
C SET UP KG AND LG. **	NASNU127	316
GO TO (160,220,220,200,120,120,120,120,120,180,120,140,140,	NASNU128	317
1 140,140,140,180,120,500,230,220,220,220,180,180,	NASNU129	318
2 140,180,180,180,180,160,160,110,114,118,118,140, 80,	NASNU130	319
3 95,120, 90, 80, 95,200,114,110,120, 90, 90),ITYPE	NASNU131	320
C* CIS308,CISH8	NASNU132	321
80 DO 81 I=1,7	NASNU133	322
81 KG(I)=A(I+1)+0.5	NASNU134	323
NCON=8	NASNU135	324
READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A	NASNU136	325
IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100	NASNU137	326
KG(8)=A(1)+0.5	NASNU138	327
GO TO 250	NASNU139	328
C* CIS3020	NASNU140	329
85 DO 86 I=1,7	NASNU141	330
86 KG(I)=A(I+1)+0.5	NASNU142	331
NCON=20	NASNU143	332
READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A	NASNU144	333
IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100	NASNU145	334
READ(8,10) F1B,A(5),A(6),A(7),A(8),F10B	NASNU146	335
IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52	NASNU147	336
DO 87 I=1,15	NASNU148	337
87 KG(I)=A(I-7)+0.5	NASNU149	338
READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A	NASNU150	339
IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100	NASNU151	340
READ(8,10) F1B,A(5),A(6),A(7),A(8),F10B	NASNU152	341
IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52	NASNU153	342
DO 88 I=16,20	NASNU154	343
88 KG(I)=A(I-15)+0.5	NASNU155	344
GO TO 250	NASNU156	345
C* CIS208,CHEXA1,CHEXA2	NASNU157	346
90 DO 91 I=1,6	NASNU158	347
91 KG(I)=A(I+2)+0.5	NASNU159	348
NCON=3	NASNU160	349
READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A	NASNU161	350
IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100	NASNU162	351
DO 92 I=7,8	NASNU163	352
92 KG(I)=A(I-6)+0.5	NASNU164	353
GO TO 250	NASNU165	354
C* CISH16	NASNU166	355
95 DO 96 I=1,7	NASNU167	356
96 KG(I)=A(I+1)+0.5	NASNU168	357
NCON=16	NASNU169	358
READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A	NASNU170	359
IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100	NASNU171	360
READ(8,10) F1B,A(5),A(6),A(7),A(8),F10B	NASNU172	361
IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52	NASNU173	362
DO 97 I=9,15	NASNU174	363
97 KG(I)=A(I-7)+0.5	NASNU175	364
READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A	NASNU176	365
IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100	NASNU177	366
KG(16)=A(1)+0.5	NASNU178	367
GO TO 250	NASNU179	368
100 F1A(1)=F1B(1)	NASNU180	369
F1A(2)=F1B(2)	NASNU181	370
DO 101 I=1,4	NASNU182	371
101 A(I)=A(I+4)	NASNU183	372
F10A(1)=F10B(1)	NASNU184	373
F10A(2)=F10B(2)	NASNU185	374
GO TO 52	NASNU186	375
C* CTRAPRG,CFLUID4	NASNU187	376
110 DO 112 I=1,4	NASNU188	377
112 KG(I)=A(I+1)+0.5	NASNU189	378
GO TO 250	NASNU190	379
C* CTRIARG,CFLUID3	NASNU191	380
114 DO 116 I=1,3	NASNU192	381
116 KG(I)=A(I+1)+0.5	NASNU193	382
GO TO 250	NASNU194	383
C* CONM1, CONM2	NASNU195	384
118 KG(1)=A(2)+0.5	NASNU196	385
KG(2)=KG(1)	NASNU197	386
GO TO 250	NASNU198	387
C* CQDMEM,CQDPLT,CQUAD1,CQUAD2,CQUAD3,CSHEAR,CTWIST,CIS2D4,CTETRA	NASNU199	388
120 DO 130 I=1,4	NASNU200	389
130 KG(I)=A(I+2)+0.5	NASNU201	390
GO TO 250	NASNU202	391
C* CTRBSC, CTRIA1, CTRIA2, CTRMEM, CTRPLT, CHTTRI2	NASNU203	392
140 DO 150 I=1,3	NASNU204	393
150 KG(I)=A(I+2)+0.5	NASNU205	394
GO TO 250	NASNU206	395
C* CBAR, CCONE4X, CTORDRG	NASNU207	396
160 DO 170 I=1,2	NASNU208	397
170 KG(I)=A(I+2)+0.5	NASNU209	398
GO TO 250	NASNU210	399
C* CROD, CTUBE, CVISC, CDAMP3, CDAMP4, CELAS3, CELAS4, CHASS3, CHASS4	NASNU211	400

180 DO 190 I=1,2	NASNU212	401
KG(I)=A(I+2)+0.5	NASNU213	402
190 LG(I)=A(I+6)+0.5	NASNU214	403
C SET LOOP=2 SINCE 2 ELEMENTS MAY BE DEFINED ON ONE CARD.	NASNU215	404
LOOP=2	NASNU216	405
GO TO 250	NASNU217	406
C* CONROD,CFLUID2	NASNU218	407
200 DO 210 I=1,2	NASNU219	408
210 KG(I)=A(I+1)+0.5	NASNU220	409
GO TO 250	NASNU221	410
C* CELAS1, CELAS2, CDAMP1, CDAMP2, CHASS1, CHASS2	NASNU222	411
220 KG(1)=A(3)+0.5	NASNU223	412
KG(2)=A(5)+0.5	NASNU224	413
GO TO 250	NASNU225	414
C PROCESS MPC CARDS.	NASNU226	415
230 NCON=NMPC	NASNU227	416
KG(1)=A(2)+0.5	NASNU228	417
KG(2)=A(5)+0.5	NASNU229	418
I=2	NASNU230	419
240 READ(8,10)F1A,(A(J),J=1,4),F10A	NASNU231	420
IF(F10B(1).NE.F1A(1).OR.F10B(2).NE.F1A(2)) GO TO 250	NASNU232	421
I=I+1	NASNU233	422
IF(I.GT.NMPC)GO TO 245	NASNU234	423
F10B(1)=F10A(1)	NASNU235	424
F10B(2)=F10A(2)	NASNU236	425
KK=2	NASNU237	426
IF(MOD(I,2).EQ.0)KK=1	NASNU238	427
KG(I)=A(KK)+0.5	NASNU239	428
GO TO 240	NASNU240	429
245 WRITE(6,246) NMPC	NASNU241	430
246 FORMAT(36H1 AN MPC EQUATION CONTAINS MORE THAN,15,8H TERMS./	NASNU242	431
+ 14H FATAL ERROR.)	NASNU243	432
CALL BOMBIT(5)	NASNU244	433
C PROCESS KG (AND LG IF LOOP=2) ARRAY.	NASNU245	434
250 DO 480 KK=1,LOOP	NASNU246	435
IF(KK.FQ.1)GO TO 300	NASNU247	436
DO 260 I=1,4	NASNU248	437
260 KG(I)=LG(I)	NASNU249	438
C SCATTER SEARCH AND CONVERT KG TO TEMPORARY SET OF INTERNAL NUMBERS.	NASNU250	439
300 CALL SCAT(KG,NCON,NEW,INV,II3,NORIG)	NASNU251	440
IF(ITYPE.NE.20)GO TO 420	NASNU252	441
C SAVE MPC GRID POINTS FOR LATER PROCESSING BY TIGER.	NASNU253	442
NEQ=NEQ+1	NASNU254	443
WRITE(11)KG	NASNU255	444
GO TO 45	NASNU256	445
C FILL CONNECTION TABLE ARRAY IG.	NASNU257	446
420 IEND=NCON-1	NASNU258	447
NEL=NEL+1	NASNU259	448
DO 450 I=1,IEND	NASNU260	449
L=I+1	NASNU261	450
DO 450 J=L,NCON	NASNU262	451
450 CALL SETIG(KG(I),KG(J),IG,II1,NORIG)	NASNU263	452
480 CONTINUE	NASNU264	453
IF(F1B(1).EQ.F10A(1).AND.F1B(2).EQ.F10A(2)) GO TO 40	NASNU265	454
IF(INCON.GE.8) GO TO 40	NASNU266	455
F1A(1)=F1B(1)	NASNU267	456
F1A(2)=F1B(2)	NASNU268	457
DO 495 I=1,4	NASNU269	458
495 A(I)=ATEMP(I)	NASNU270	459
F10A(1)=F10B(1)	NASNU271	460
F10A(2)=F10B(2)	NASNU272	461
GO TO 45	NASNU273	462
500 NN=NEW	NASNU274	463
IF(NEW.GT.0) GO TO 502	NASNU275	464
WRITE(6,2)	NASNU276	465
IPARAM(9)=4	NASNU277	466
RETURN	NASNU278	467
502 IF(IPARAM(4).EQ.3)GO TO 505	NASNU279	468
C MODIFY CONNECTION TABLE TO ACCOUNT FOR MPC EQUATIONS.	NASNU280	469
CALL TIGER(NEQ,IG,II1,ILD,NORIG)	NASNU281	470
NDEP=NN	NASNU282	471
CALL FIXIT(ILD,NDEP)	NASNU283	472
C GENERATE NEW IG AND NORIG ARRAYS.	NASNU284	473
505 CALL BRIGIT(IG,II1,INV,II3,INT,ICC,NORIG,IP)	NASNU285	474
C PRINT INTERNAL/EXTERNAL CORRESPONDENCE TABLE.	NASNU286	475
LEN=50	NASNU287	476
IF(IPARAM(10).EQ.5) GO TO 560	NASNU288	477
J=0	NASNU289	478
510 WRITE(6,19)	NASNU290	479
520 J=J+1	NASNU291	480
KEND=0	NASNU292	481
DO 530 K=1,9,2	NASNU293	482
L=J+LEN*(K-1)/2	NASNU294	483
LINE(K)=L	NASNU295	484
IF(L.GT.NEW) GO TO 550	NASNU296	485
KEND=K+1	NASNU297	486
530 LINE(K+1)=NORIG(L)	NASNU298	487
550 CONTINUE	NASNU299	488
IF(KEND.EQ.0)GO TO 560	NASNU300	489
WRITE(6,11)(LINE(K),K=1,KEND)	NASNU301	490
IF(MOD(J,LEN).NE.0)GO TO 520	NASNU302	491
J=J+4*LEN	NASNU303	492
IF(J.LT.NEW) GO TO 510	NASNU304	493
560 CONTINUE	NASNU305	494
C CONVERT ISTART, IGNORE, IFIRST FROM ORIGINAL TO INTERNAL NUMBERS.	NASNU306	495
I=ISTA+IG+IFIR	NASNU307	496
IF(I.LE.0) GO TO 570	NASNU308	497
CALL FLIP(ISTART,ISTA,INV,II3,ICC)	NASNU309	498
CALL FLIP(IGNORE,IG,INV,II3,ICC)	NASNU310	499
CALL FLIP(IFIRST,IFIR,INV,II3,ICC)	NASNU311	500

IF(IPARAM(10).EQ.5) GO TO 570	NASNU312	501
C PRINT INTERNAL NUMBERS FOR S-CARDS.	NASNU313	502
WRITE(6,561)	NASNU314	503
561 FORMAT(30H1 \$ CARDS (INTERNAL NUMBERS) /)	NASNU315	504
IF(ISTA.GT.0) WRITE(6,562) (ISTART(I),I=1,ISTA)	NASNU316	505
IF(IIG.GT.0) WRITE(6,564) (IGNORE(I),I=1,IIG)	NASNU317	506
IF(IFIR.GT.0) WRITE(6,566) (IFIRST(I),I=1,IFIR)	NASNU318	507
562 FORMAT(9H \$START ,20I5/100(9X,20I5/))	NASNU319	508
564 FORMAT(9H \$IGNORE ,20I5/100(9X,20I5/))	NASNU320	509
566 FORMAT(9H \$FIRST ,20I5/100(9X,20I5/))	NASNU321	510
570 CONTINUE	NASNU322	511
C SET UP LIST OF POINTS TO IGNORE IN INT ARRAY.	NASNU323	512
K=0	NASNU324	513
IF(IPARAM(4).EQ.3) GO TO 920	NASNU325	514
IF(NDEP.LE.0) GO TO 920	NASNU326	515
C MPC DEPENDENT POINTS FIRST.	NASNU327	516
DO 915 I=1,NDEP	NASNU328	517
J=ILO(I)	NASNU329	518
IF(J.LE.0) GO TO 915	NASNU330	519
K=K+1	NASNU331	520
INT(K)=ICC(J)	NASNU332	521
IF(K.GE.MAXGRD) CALL FIXIT(INT,K)	NASNU333	522
915 CONTINUE	NASNU334	523
920 IF(IGDEG.LE.0) GO TO 940	NASNU335	524
C GRID POINTS WITH DEGREE.GT.IGDEG SECOND.	NASNU336	525
IF(IGDEG.GE.MM) GO TO 940	NASNU337	526
CALL DEGREE(IG,II,INV)	NASNU338	527
C HERE, INV(I)=DEGREE OF GRID POINT I	NASNU339	528
DO 930 I=1,NN	NASNU340	529
IF(JNV(I).LE.IGDEG) GO TO 930	NASNU341	530
K=K+1	NASNU342	531
INT(K)=I	NASNU343	532
IF(K.GE.MAXGRD) CALL FIXIT(INT,K)	NASNU344	533
930 CONTINUE	NASNU345	534
940 IF(IIG.LE.0) GO TO 960	NASNU346	535
C \$IGNORE POINTS THIRD.	NASNU347	536
DO 950 I=1,IIG	NASNU348	537
J=IGNORE(I)	NASNU349	538
IF(J.LE.0) GO TO 950	NASNU350	539
K=K+1	NASNU351	540
INT(K)=J	NASNU352	541
IF(K.GE.MAXGRD) CALL FIXIT(INT,K)	NASNU353	542
950 CONTINUE	NASNU354	543
C K=NUMBER OF POINTS TO BE IGNORED BEFORE COMPRESSING LIST.	NASNU355	544
960 IF(K.LE.0) GO TO 970	NASNU356	545
C DELETE POINTS LISTED IN INT ARRAY FROM CONNECTION TABLE IG.	NASNU357	546
CALL MORRIS(INT,K,IG,II)	NASNU358	547
970 CONTINUE	NASNU359	548
C RENUMBER NODES WITH SUBROUTINE SCHEME.	NASNU360	549
IF(IPARAM(10).EQ.6) IARG(5)=1	NASNU361	550
II8=II3/2	NASNU362	551
CALL SECOND(TIM1)	NASNU363	552
CALL SCHEME(IARG(1),IARG(2),IARG(3),IARG(4),IARG(5),IG,II1,	NASNU364	553
+ JNV(1),JNV(II8+1),JNV(2*II8+1),JNV(3*II8+1),INT,ICC,ILO,IP)	NASNU365	554
CALL SECOND(TIM2)	NASNU366	555
TIM2=TIM2-TIM1	NASNU367	556
IF(IPARAM(10).EQ.5) GO TO 580	NASNU368	557
WRITE(6,15)TIM2	NASNU369	558
WRITE(6,4)I9	NASNU370	559
C WRITE NEW NASTRAN DATA DECK.	NASNU371	560
580 READ(9,9)B	NASNU372	561
WRITE(8,9)B	NASNU373	562
IF(B(1).NE.9EGI)GO TO 580	NASNU374	563
590 READ(9,9)B	NASNU375	564
IF(B(1).GE.SEQG.OR.R(1).EQ.ENDD)GO TO 600	NASNU376	565
WRITE(8,9)B	NASNU377	566
GO TO 590	NASNU378	567
C WRITE SEQGP CARDS.	NASNU379	568
600 KREM=MOD(NEW,4)	NASNU380	569
IF(NEW.GE.4) GO TO 605	NASNU381	570
KBEG=1	NASNU382	571
GO TO 612	NASNU383	572
605 IEND=NEW-KREM-3	NASNU384	573
DO 610 K=1,IEND,4	NASNU385	574
L=K+3	NASNU386	575
610 WRITE(A,12) (NORIG(I),ILO(I),I=K,L)	NASNU387	576
IF(KREM.EQ.0)GO TO 620	NASNU388	577
KBEG=IEND+4	NASNU389	578
612 DO 615 I=KBEG,NEW	NASNU390	579
615 WRITE(8,8) NORIG(I),ILO(I)	NASNU391	580
C WRITE THE REMAINDER OF THE NASTRAN DECK.	NASNU392	581
620 WRITE(8,9)B	NASNU393	582
IF(B(1).EQ.ENDD)GO TO 700	NASNU394	583
READ(9,9)B	NASNU395	584
GO TO 620	NASNU396	585
700 CONTINUE	NASNU397	586
IF(IPARAM(10).EQ.5) GO TO 900	NASNU398	587
C PRINT ORIGINAL GRID POINT CONNECTION TABLE.	NASNU399	588
MAXD=MM	NASNU400	589
L=MAXD/11+1	NASNU401	590
L=LEN/L	NASNU402	591
705 FORMAT(10H1 GRID,5X,5H MAX,15X,13H*CONNECTIONS*,5X,	NASNU403	592
+ 23H(ORIGINAL GRID NUMBERS) /5X,	NASNU404	593
+ 20HPOINT COMP DIST DEGR ,11(8X,1H*))	NASNU405	594
710 FORMAT(10,3I5,11I9/25(25X,11I9/))	NASNU406	595
DO 750 I=1,NN	NASNU407	596
IF(MOD(I,L).EQ.1) WRITE(6,705)	NASNU408	597
DO 720 J=1,MAXD	NASNU409	598
720 IP(J)=0	NASNU410	599
C CALCULATE MOIST AND PRINT TABLE.	NASNU411	600

```

MDIST=0
DO 725 J=1,MAXD
K=IUNPK(IG,MAXGRD*(J-1)+I,NBITIN)
IF(K.EQ.0) GO TO 725
MDIST=MAX0(MDIST,IABS(I-K))
IP(J)=NORIG(K)
725 CONTINUE
K=NORIG(I)
IP1=INV(I,1)
IP2=INV(MAXGRD+I,1)
750 WRITE(6,710) K,IP1,MDIST,IP2,(IP(J),J=1,MAXD)
C PRINT CONNECTION TABLE FOR RENUMBERED NUMBERS.
DO 780 I=1,NEW
780 ICC(I)=ILO(I)
CALL SWITCH(IG,II1,INT,ICC,IP(1),IP(MAXDEG+1))
CALL DEGREE(IG,II1,JNV(II8+1))
L=COMPNT(IG,II1,JNV(1),JNV(II8+1),JNV(3*II8+1),ICC)
L=MAXD/26+1
L=LENL
805 FORMAT(37H1LABEL COMP MDIST DEGR CONNECTIONS ,10X,
+ 20H(RENUMBERED) NUMBERS)
810 FORMAT(5I6,20I5/ 25(25X,21I5/))
DO 850 I=1,NN
IF(MD(I,L).EQ.1) WRITE(6,805)
DO 820 J=1,MAXD
820 IP(J)=0
C CALCULATE MDIST AND PRINT TABLE.
MDIST=0
DO 825 J=1,MAXD
K=IUNPK(IG,MAXGRD*(J-1)+I,NBITIN)
IF(K.EQ.0) GO TO 825
MDIST=MAX0(MDIST,IABS(I-K))
IP(J)=K
825 CONTINUE
C INV(I,1)=IC(I) BEFORE PACKING
C INV(MAXGRD+I,1)=IDEG(I) BEFORE PACKING
IP1=INV(I,1)
IP2=INV(MAXGRD+I,1)
850 WRITE(6,810) I,IP1,MDIST,IP2,(IP(J),J=1,MAXD)
900 RETURN
END
SUBROUTINE FLIP(LIST,N,INV,II3,ICC)
C CONVERT $-ARRAY LIST OF LENGTH N FROM ORIGINAL TO INTERNAL NUMBERS.
COMMON /A/ MAXGRD,MAXDEG,KMOD
DIMENSION LIST(1),INV(II3,2),ICC(1)
C CHECK FOR DUPLICATE AND ZERO ENTRIES AND REDUCE N IF NECESSARY.
CALL FIXIT(LIST,N)
IF(N.LE.0) RETURN
DO 20 I=1,N
J=LIST(I)
IF(J.LE.0) GO TO 30
LOC=J-1
10 LOC=MOD(LOC,KMOD)+1
IF(INV(LOC,1).EQ.0) GO TO 30
IF(INV(LOC,1).NE.J) GO TO 10
K=INV(LOC,2)
LIST(I)=ICC(K)
20 CONTINUE
RETURN
30 WRITE(6,40) J
40 FORMAT(11H1GRID POINT ,I10,30H APPEARING ON A $ CARD IS NOT
+ 25H A STRUCTURAL GRID POINT. /13H FATAL ERROR. )
CALL BOMBIT(0)
END
SUBROUTINE GOOGAN(KA,KB,NIN,NOUT)
C THIS ROUTINE READS A NASTRAN DATA DECK AND RIGHT-ADJUSTS ALL
C BULK DATA IN ITS FIELDS.
C IN ADDITION, THE CALLING ARGUMENTS PROVIDE THE FOLLOWING OPTIONS -
C KA=1, PROCESS ALL CARDS IN THE NASTRAN DATA DECK, OR
C =2, PROCESS ONLY THOSE CARDS WITH A C OR G IN COLUMN 1,
C MPC CARDS, AND THOSE CONTINUATION CARDS WITH ALL
C NUMERIC FIELDS. THE ENDDATA CARD IS WRITTEN IN ANY CASE.
C KB = 1, CONVERT ALL 8 COLUMN FIELDS TO 16 COLUMN FIELDS, OR
C = 2, THE FIELD WIDTHS REMAIN UNCHANGED.
C NIN = THE LOGICAL UNIT FROM WHICH THE INPUT DECK IS READ.
C NOUT = THE LOGICAL UNIT ON WHICH THE OUTPUT IS WRITTEN.
C NEITHER NIN NOR NOUT ARE REWOUND IN THIS ROUTINE.
C IF AN ASTERISK APPEARS IN FIELD 1 AFTER THE MNEMONIC, IT IS LEFT-
C ADJUSTED AGAINST THE MNEMONIC.
C THE FOLLOWING TWO (2) CARDS ARE REQUIRED IN THE DATA DECK -
C (1) A BEGIN BULK CARD TO INDICATE THE BEGINNING OF THE
C BULK DATA DECK, AND
C (2) AN ENDDATA CARD TO INDICATE THE END OF THE DATA DECK.
C ALL CARDS PRECEDING THE BEGIN BULK CARD ARE WRITTEN ON NOUT IFF KA=1.
DIMENSION ANUM(10)
COMMON A(80),IP(40)
COMMON IA,IB,ICARD,IFLAG,J,JNB,L,MK HOLD,MKINSR,MKNIN
COMMON NBLANK,NFIELD,I,ICOL,IFIELD,IPROC,ITYPE
COMMON K,KAST,KBLK,MKI,MKJ,NCOL,NIP,NN
COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC
COMMON /B/ IPARAM(20),IARG(5)
COMMON /DOL/ ISTART(100),IGNORE(100),IFIRST(100)
COMMON /DOLL/ IDIH,ISTA,IIG,IFIR,IGDEG,ISCH
COMMON /NG/ NGRID
REAL M,N,II,LL,JJ,KK
INTEGER EOF
C DATA CARDS FOR ALPHABET (ALLOWS FOR FUTURE ADDITIONS TO
C USER OPTION LIST).
DATA B,C,D,E,G,M,N,P,1HD,1HC,1HD,1HE,1HG,1HM,1HN,1HP/

```

```

NASNU412 601
NASNU413 602
NASNU414 603
NASNU415 604
NASNU416 605
NASNU417 606
NASNU418 607
NASNU419 608
NASNU420 609
NASNU421 610
NASNU422 611
NASNU423 612
NASNU424 613
NASNU425 614
NASNU426 615
NASNU427 616
NASNU428 617
NASNU429 618
NASNU430 619
NASNU431 620
NASNU432 621
NASNU433 622
NASNU434 623
NASNU435 624
NASNU436 625
NASNU437 626
NASNU438 627
NASNU439 628
NASNU440 629
NASNU441 630
NASNU442 631
NASNU443 632
NASNU444 633
NASNU445 634
NASNU446 635
NASNU447 636
NASNU448 637
NASNU449 638
NASNU450 639
NASNU451 640
NASNU452 641
FLIP 2 642
FLIP 3 643
FLIP 4 644
FLIP 5 645
FLIP 6 646
FLIP 7 647
FLIP 8 648
FLIP 9 649
FLIP 10 650
FLIP 11 651
FLIP 12 652
FLIP 13 653
FLIP 14 654
FLIP 15 655
FLIP 16 656
FLIP 17 657
FLIP 18 658
FLIP 19 659
FLIP 20 660
FLIP 21 661
FLIP 22 662
FLIP 23 663
FLIP 24 664
FLIP 25 665
GOOGAN 2 666
GOOGAN 3 667
GOOGAN 4 668
GOOGAN 5 669
GOOGAN 6 670
GOOGAN 7 671
GOOGAN 8 672
GOOGAN 9 673
GOOGAN10 674
GOOGAN11 675
GOOGAN12 676
GOOGAN13 677
GOOGAN14 678
GOOGAN15 679
GOOGAN16 680
GOOGAN17 681
GOOGAN18 682
GOOGAN19 683
GOOGAN20 684
GOOGAN21 685
GOOGAN22 686
GOOGAN23 687
GOOGAN24 688
GOOGAN25 689
GOOGAN26 690
GOOGAN27 691
GOOGAN28 692
GOOGAN29 693
GOOGAN30 694
GOOGAN31 695
GOOGAN32 696
GOOGAN33 697
GOOGAN34 698
GOOGAN35 699
GOOGAN36 700

```

```

DATA AA,II,LL,0,R/1HA,1HI,1ML,1MO,1HR/
DATA Q,S,T,U,Y/1HQ,1HS,1HT,1HU,1HY/
DATA F,M,JJ,KK/1HF,1HM,1HJ,1HK/
DATA V,W,X,Z/1HV,1HW,1HX,1HZ/
DATA ASTER,PLUS,BLANK,DOLLAR/1H*,1H+,1H-,1H$,
DATA ANUM/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/
DATA LFLAG/0/
DATA IROMB,IROM/0,0/
LFLAG=LFLAG+1
9 FORMAT(1H1)
10 FORMAT(80A1)
11 FORMAT(8A1,4(8X,8A1),3H*XZ,I5/3H*XZ,I5,4(8X,8A1),8A1)
ICARD=0
MKINSR=12
MKNIN=NIN
C READ EXECUTIVE OR CASE CONTROL CARD.
20 READ(NIN,10)A
IF(EOF(NIN).EQ.0)GO TO 21
IF(NIN.EQ.MKNIN)CALL BOMBIT(1)
MKHOLD=NIN
NIN=MKINSR
MKINSR=MKHOLD
GO TO 20
21 IFLAG=0
ICARD=ICARD+1
C PROCESS OUTPUT OPTION CARD, IF PRESENT.
IF(A(1).NE.00LLAR)GO TO 26
IF(LFLAG.GT.1) GO TO 29
C LOOK FOR FIRST KEYWORD.
ITYPE=0
IF(A(2).EQ.P.AND.A(3).EQ.U)ITYPE=1
IF(A(2).EQ.M.AND.A(3).EQ.P)ITYPE=4
IF(A(2).EQ.S.AND.A(3).EQ.E)ITYPE=5
IF(A(2).EQ.R.AND.A(3).EQ.II)ITYPE=6
IF(A(2).EQ.N.AND.A(3).EQ.AA)ITYPE=8
IF(A(2).EQ.P.AND.A(3).EQ.R)ITYPE=10
IF(A(2).EQ.S.AND.A(3).EQ.C)GO TO 1100
IF(A(2).EQ.S.AND.A(3).EQ.T) GO TO 1200
IF(A(2).EQ.D.AND.A(3).EQ.E) GO TO 1250
IF(A(2).EQ.F.AND.A(3).EQ.II) GO TO 1300
IF(A(2).EQ.II.AND.A(3).EQ.G) GO TO 1350
IF(A(2).EQ.G.AND.A(3).EQ.R) GO TO 1380
IF(A(2).EQ.AA.AND.A(3).EQ.T) ITYPE=12
IF(A(2).EQ.W.AND.A(3).EQ.AA) ITYPE=13
IF(A(2).NE.II.OR.A(3).NE.N)GO TO 1025
C
INSERT CARDS FROM ALTERNATE FILE
IPARAM(11)=1
MKHOLD=NIN
NIN=MKINSR
MKINSR=MKHOLD
DO 1021 MKI=2,80
MKJ=81-MKI
1021 A(MKJ+1)=A(MKI)
IPARAM(6)=4
1025 IF(ITYPE.EQ.0)GO TO 26
C LOOK FOR SECOND KEYWORD.
I=3
22 I=I+1
IF(I.GE.79)GO TO 26
IF(A(I).NE.BLANK)GO TO 22
24 I=I+1
IF(I.GE.80)GO TO 26
IF(A(I).EQ.BLANK)GO TO 24
J=0
IF(A(I).EQ.S.AND.A(I+1).EQ.E)J=1
IF(A(I).EQ.AA.AND.A(I+1).EQ.LL)J=2
IF(A(I).EQ.N.AND.A(I+1).EQ.O)J=3
IF(A(I).EQ.Y.AND.A(I+1).EQ.E)J=4
IF(A(I).EQ.M.AND.A(I+1).EQ.II) J=5
IF(A(I).EQ.M.AND.A(I+1).EQ.AA) J=6
IF(J.EQ.0)GO TO 26
C SET
PARAMETER.
IPARAM(ITYPE)=J
GO TO 26
C READ $SCHEME CARD.
1100 CALL READIT(A,IP,NIP)
ISCH=1
I=MIND(NIP,5)
IF(I.EQ.0) GO TO 29
DO 1110 J=1,I
1110 IARG(J)=IP(J)
GO TO 29
C READ $START CARD.
1200 CALL READIT(A,IP,NIP)
I=ISTA
ISTA=ISTA+NIP
IF(ISTA.LE.IDIM) GO TO 1205
IBOM=2
ISTA=IDIM
GO TO 29
1205 DO 1210 J=1,NIP
1210 ISTART(I+J)=IP(J)
GO TO 29
C READ $DEGREE CARD.
1250 CALL READIT(A,IP,NIP)
IGDEG=IP(1)
GO TO 29
C READ $FIRST CARD.
1300 CALL READIT(A,IP,NIP)
I=IFIR

```

```

GOOGAN37 701
GOOGAN38 702
GOOGAN39 703
GOOGAN40 704
GOOGAN41 705
GOOGAN42 706
GOOGAN43 707
GOOGAN44 708
GOOGAN45 709
GOOGAN46 710
GOOGAN47 711
GOOGAN48 712
GOOGAN49 713
GOOGAN50 714
GOOGAN51 715
GOOGAN52 716
GOOGAN53 717
GOOGAN54 718
GOOGAN55 719
GOOGAN56 720
GOOGAN57 721
GOOGAN58 722
GOOGAN59 723
GOOGAN60 724
GOOGAN61 725
GOOGAN62 726
GOOGAN63 727
GOOGAN64 728
GOOGAN65 729
GOOGAN66 730
GOOGAN67 731
GOOGAN68 732
GOOGAN69 733
GOOGAN70 734
GOOGAN71 735
GOOGAN72 736
GOOGAN73 737
GOOGAN74 738
GOOGAN75 739
GOOGAN76 740
GOOGAN77 741
GOOGAN78 742
GOOGAN79 743
GOOGAN80 744
GOOGAN81 745
GOOGAN82 746
GOOGAN83 747
GOOGAN84 748
GOOGAN85 749
GOOGAN86 750
GOOGAN87 751
GOOGAN88 752
GOOGAN89 753
GOOGAN90 754
GOOGAN91 755
GOOGAN92 756
GOOGAN93 757
GOOGAN94 758
GOOGAN95 759
GOOGAN96 760
GOOGAN97 761
GOOGAN98 762
GOOGAN99 763
GOOGA100 764
GOOGA101 765
GOOGA102 766
GOOGA103 767
GOOGA104 768
GOOGA105 769
GOOGA106 770
GOOGA107 771
GOOGA108 772
GOOGA109 773
GOOGA110 774
GOOGA111 775
GOOGA112 776
GOOGA113 777
GOOGA114 778
GOOGA115 779
GOOGA116 780
GOOGA117 781
GOOGA118 782
GOOGA119 783
GOOGA120 784
GOOGA121 785
GOOGA122 786
GOOGA123 787
GOOGA124 788
GOOGA125 789
GOOGA126 790
GOOGA127 791
GOOGA128 792
GOOGA129 793
GOOGA130 794
GOOGA131 795
GOOGA132 796
GOOGA133 797
GOOGA134 798
GOOGA135 799
GOOGA136 800

```

IFIR=IFIR+NIP	GOOGA137	801
IF(IFIR.LE.IDIM) GO TO 1308	GOOGA138	802
IBOM=2	GOOGA139	803
IFIR=IDIM	GOOGA140	804
GO TO 29	GOOGA141	805
1308 DO 1310 J=1,NIP	GOOGA142	806
1310 IFIRST(I+J)=IP(J)	GOOGA143	807
GO TO 29	GOOGA144	808
C READ \$IGNORE CARD.	GOOGA145	809
1350 CALL READIT(A,IP,NIP)	GOOGA146	810
I=IIG	GOOGA147	811
IIG=IIG+NIP	GOOGA148	812
IF(IIG.LE.IDIM) GO TO 1360	GOOGA149	813
IBOM=2	GOOGA150	814
IIG=IDIM	GOOGA151	815
GO TO 29	GOOGA152	816
1360 DO 1365 J=1,NIP	GOOGA153	817
1365 IGNORE(I+J)=IP(J)	GOOGA154	818
GO TO 29	GOOGA155	819
C READ \$GRID CARD.	GOOGA156	820
1380 CALL READIT(A,IP,NIP)	GOOGA157	821
NGRID=IP(1)	GOOGA158	822
GO TO 29	GOOGA159	823
C LOOK FOR BEGIN BULK CARD.	GOOGA160	824
26 I=0	GOOGA161	825
27 I=I+1	GOOGA162	826
IF(I.GT.75) GO TO 29	GOOGA163	827
IF(A(I).EQ.BLANK) GO TO 27	GOOGA164	828
IF(A(I).NE.B) GO TO 29	GOOGA165	829
IF(A(I+1).NE.E) GO TO 29	GOOGA166	830
IF(A(I+2).NE.G) GO TO 29	GOOGA167	831
IF(A(I+3).NE.H) GO TO 29	GOOGA168	832
IFLAG=1	GOOGA169	833
C LEFT-ADJUST BEGIN BULK CARD.	GOOGA170	834
K=73-I	GOOGA171	835
DO 2A J=1,72	GOOGA172	836
IF(J.LE.K) A(J)=A(J+I-1)	GOOGA173	837
28 IF(J.GT.K) A(J)=BLANK	GOOGA174	838
IF(LFLAG.GT.1) GO TO 29	GOOGA175	839
C REJECT ILLEGAL PARAMETERS AND SET TO DEFAULTS.	GOOGA176	840
IF(IPARAM(1).NE.2.AND.IPARAM(1).NE.3) IPARAM(1)=1	GOOGA177	841
DO 1450 I=2,9	GOOGA178	842
1450 IF(IPARAM(I).NE.4) IPARAM(I)=3	GOOGA179	843
IF(IPARAM(10).NE.6) IPARAM(10)=5	GOOGA180	844
IF(IPARAM(12).NE.3) IPARAM(12)=4	GOOGA181	845
IF(IPARAM(13).NE.4) IPARAM(13)=3	GOOGA182	846
CALL GRID(NGRID)	GOOGA183	847
I=ISTA+IIG+IFIR+ISCH+IGDEG	GOOGA184	848
IF(I.LE.0) GO TO 29	GOOGA185	849
C CHECK FOR ILLEGAL SCHEME ARGUMENTS.	GOOGA186	850
DO 1460 I=1,3	GOOGA187	851
1460 IF(IARG(I).LT.1.OR.IARG(I).GT.MAXGRD) IBOMB=1	GOOGA188	852
IF(IARG(4).LT.2.OR.IARG(4).GT.3) IBOMB=1	GOOGA189	853
IF(IARG(5).LT.0.OR.IARG(5).GT.1) IBOMB=1	GOOGA190	854
WRITE(6,9)	GOOGA191	855
IF(ISCH.GT.0) WRITE(6,1500) (IARG(I),I=1,5)	GOOGA192	856
FORMAT(//,9H \$SCHEME ,10I10/200(9X,10I10/))	GOOGA193	857
IF(ISTA.GT.0) WRITE(6,1505) (ISTART(I),I=1,ISTA)	GOOGA194	858
1505 FORMAT(//,9H \$START ,10I10/200(9X,10I10/))	GOOGA195	859
IF(IGDEG.GT.0) WRITE(6,1510) IGDEG	GOOGA196	860
1510 FOPMAT(//,9H \$DEGREE ,10I10/200(9X,10I10/))	GOOGA197	861
IF(IFIR.GT.0) WRITE(6,1515) (IFIRST(I),I=1,IFIR)	GOOGA198	862
1515 FORMAT(//,9H \$FIRST ,10I10/200(9X,10I10/))	GOOGA199	863
IF(IIG.GT.0) WRITE(6,1520) (IGNORE(I),I=1,IIG)	GOOGA200	864
1520 FORMAT(//,9H \$IGNORE ,10I10/200(9X,10I10/))	GOOGA201	865
IF(IBOMB.EQ.1) CALL BOMBIT(4)	GOOGA202	866
IF(IBOMB.EQ.2) CALL BOMBIT(9)	GOOGA203	867
29 IF(KA.EQ.1) WRITE(NOUT,10)A	GOOGA204	868
IF(IFLAG.EQ.0) GO TO 20	GOOGA205	869
C RETURN IF RIGHT-ADJUSTING OF CARDS IS NOT NEEDED.	GOOGA206	870
IF(IPARAM(5).EQ.3.AND.IPARAM(6).EQ.3) RETURN	GOOGA207	871
C READ BULK DATA CARD.	GOOGA208	872
30 READ(NIN,10)A	GOOGA209	873
IF(EOF(NIN).EQ.0) GO TO 31	GOOGA210	874
IF(NIN.EQ.MKNIN) CALL BOMBIT(1)	GOOGA211	875
C SWITCH INPUT FILES	GOOGA212	876
MKHOLD=NIN	GOOGA213	877
NIN=MKINSR	GOOGA214	878
MKINSR=MKHOLD	GOOGA215	879
GO TO 30	GOOGA216	880
31 ICARD=ICARD+1	GOOGA217	881
C LEFT-ADJUST FIRST FIELD.	GOOGA218	882
DO 1600 I=1,8	GOOGA219	883
IF(A(I).NE.BLANK) GO TO 1610	GOOGA220	884
1600 CONTINUE	GOOGA221	885
GO TO 30	GOOGA222	886
1610 IF(I.EQ.1) GO TO 1650	GOOGA223	887
J=I-1	GOOGA224	888
K=8-J	GOOGA225	889
DO 1620 I=1,K	GOOGA226	890
A(I)=A(I+J)	GOOGA227	891
1620 A(I+J)=BLANK	GOOGA228	892
1650 CONTINUE	GOOGA229	893
C LOOK FOR SEQGP CARD.	GOOGA230	894
IF(A(1).EQ.S.AND.A(2).EQ.E.AND.A(3).EQ.Q.AND.A(4).EQ.G) IPARAM(7)=4	GOOGA231	895
C LOOK FOR COMMENT CARD.	GOOGA232	896
IF(A(1).EQ.DOLLAR.AND.KA.EQ.1) GO TO 35	GOOGA233	897
C LOOK FOR ENDDATA CARD.	GOOGA234	898
I=0	GOOGA235	899
32 I=I+1	GOOGA236	900

IF(I.GT.75)GO TO 35	GOOGA237	901
IF(A(I).EQ.BLANK)GO TO 32	GOOGA238	902
IF(A(I).NE.E)GO TO 40	GOOGA239	903
IF(A(I+1).NE.N)GO TO 40	GOOGA240	904
IF(A(I+2).NE.D)GO TO 40	GOOGA241	905
IF(A(I+3).NE.D)GO TO 40	GOOGA242	906
C LEFT-ADJUST ENDDATA CARD.	GOOGA243	907
K=73-I	GOOGA244	908
DO 33 J=1,72	GOOGA245	909
IF(J.LE.K)A(J)=A(J+I-1)	GOOGA246	910
33 IF(J.GT.K)A(J)=BLANK	GOOGA247	911
WRITE(NOUT,10)A	GOOGA248	912
RETURN	GOOGA249	913
35 WRITE(NOUT,10)A	GOOGA250	914
GO TO 30	GOOGA251	915
C DETERMINE IF CARD IS TO BE PROCESSED.	GOOGA252	916
40 IF(KA.EQ.1)GO TO 150	GOOGA253	917
IF(A(1).EQ.C.OR.A(1).EQ.G)GO TO 150	GOOGA254	918
IF(A(1).EQ.M.AND.A(2).EQ.P)GO TO 150	GOOGA255	919
NCOL=8	GOOGA256	920
IF(A(1).EQ.ASTER)GO TO 50	GOOGA257	921
IF(A(1).EQ.PLUS)GO TO 60	GOOGA258	922
GO TO 30	GOOGA259	923
50 NCOL=16	GOOGA260	924
60 NFIELD=64/NCOL	GOOGA261	925
I=0	GOOGA262	926
70 I=I+1	GOOGA263	927
IF(I.GT.NFIELD)GO TO 150	GOOGA264	928
IPROC=0	GOOGA265	929
IFLAG=0	GOOGA266	930
J=0	GOOGA267	931
80 J=J+1	GOOGA268	932
IF(IPROC.EQ.1)GO TO 70	GOOGA269	933
IF(J.LE.NCOL)GO TO 90	GOOGA270	934
IF(IFLAG.EQ.1)GO TO 30	GOOGA271	935
GO TO 70	GOOGA272	936
90 ICOL=8+NCOL*(I-1)+J	GOOGA273	937
IF(A(ICOL).EQ.BLANK)GO TO 80	GOOGA274	938
IFLAG=1	GOOGA275	939
DO 100 L=1,10	GOOGA276	940
100 IF(A(ICOL).EQ.ANUM(L))IPROC=1	GOOGA277	941
GO TO 80	GOOGA278	942
C PROCESS FIRST FIELD.	GOOGA279	943
150 NCOL=8	GOOGA280	944
KAST=8	GOOGA281	945
KBLK=8	GOOGA282	946
DO 160 I=1,8	GOOGA283	947
IF(A(I).NE.BLANK.AND.A(I).NE.ASTER.AND.A(I+1).EQ.BLANK)KBLK=I+1	GOOGA284	948
IF(A(I).EQ.ASTER)KAST=I	GOOGA285	949
160 IF(A(I).EQ.ASTER)NCOL=16	GOOGA286	950
IF(A(1).EQ.PLUS)NCOL=8	GOOGA287	951
IF(NCOL.EQ.16)GO TO 170	GOOGA288	952
IF(KB.EQ.2)GO TO 200	GOOGA289	953
IF(A(1).NE.PLUS)A(KBLK)=ASTER	GOOGA290	954
IF(A(1).EQ.PLUS)A(1)=ASTER	GOOGA291	955
GO TO 200	GOOGA292	956
170 IF(A(1).EQ.ASTER)GO TO 200	GOOGA293	957
IA=MIN0(KAST,KBLK)	GOOGA294	958
IB=MAX0(KAST,KBLK)	GOOGA295	959
A(IB)=BLANK	GOOGA296	960
A(IA)=ASTER	GOOGA297	961
C RIGHT-ADJUST ALL BULK DATA WHICH IS TO BE PROCESSED.	GOOGA298	962
200 NFIELD=64/NCOL	GOOGA299	963
IFIELD=0	GOOGA300	964
210 IFIELD=IFIELD+1	GOOGA301	965
IF(IFIELD.GT.NFIELD)GO TO 300	GOOGA302	966
I=0	GOOGA303	967
220 I=I+1	GOOGA304	968
IF(I.GT.NCOL)GO TO 210	GOOGA305	969
ICOL=9+NCOL*IFIELD-I	GOOGA306	970
IF(A(ICOL).EQ.BLANK)GO TO 220	GOOGA307	971
NBLANK=I-1	GOOGA308	972
NN=NCOL-NBLANK	GOOGA309	973
DO 230 I=1,NCOL	GOOGA310	974
J=9+NCOL*IFIELD-I	GOOGA311	975
JNB=J-NBLANK	GOOGA312	976
IF(I.LE.NN)A(J)=A(JNB)	GOOGA313	977
IF(I.GT.NN)A(J)=BLANK	GOOGA314	978
230 CONTINUE	GOOGA315	979
GO TO 210	GOOGA316	980
C WRITE NEW CARD.	GOOGA317	981
300 IF(KB.EQ.1) A(73)=ASTER	GOOGA318	982
IF(NCOL.EQ.8.AND.KB.EQ.1)GO TO 310	GOOGA319	983
WRITE(NOUT,10)A	GOOGA320	984
GO TO 30	GOOGA321	985
310 WRITE(NOUT,11) (A(I),I=1,40),ICARD,ICARD,(A(I),I=41,80)	GOOGA322	986
GO TO 30	GOOGA323	987
END	GOOGA324	988
SUBROUTINE GRID(NGRID)	GRID 2	989
C PARTITION EXPANDABLE CORE.	GRID 3	990
COMMON /BITS/ NBITIN,NBITEX	GRID 4	991
COMMON /A/ MAXGRD,MAXDEG	GRID 5	992
COMMON /K/ II(7),KOR	GRID 6	993
MAX=16384	GRID 7	994
N=NGRID	GRID 8	995
IF(N.GT.2045) NBITIN=15	GRID 9	996
IF(N.LE.510) NBITIN=10	GRID 10	997
IF(N.LT.100) N=100	GRID 11	998
IF(N.GT.MAX) GO TO 40	GRID 12	999
C CALCULATE WIDTH II(2) OF IG MATRIX.	GRID 13	1000

20	L=60/NBITIN	GRID 14	1001
	M=60/NBITEX	GRID 15	1002
	N=N+L*M-1	GRID 16	1003
	N=N-MOD(N,L*M)	GRID 17	1004
	MAXGRD=N	GRID 18	1005
C	I=PACKED LENGTH FOR INTERNAL NUMBER.	GRID 19	1006
C	J=PACKED LENGTH FOR ORIGINAL NUMBER.	GRID 20	1007
	I=N/L	GRID 21	1008
	J=N/M	GRID 22	1009
C	SET UP DIMENSIONS IN II ARRAY, WHERE IG(II1,II2),INV(II3,2),	GRID 23	1010
C	INT(II4),ICC(II5),ILO(II6),NORIG(II7)	GRID 24	1011
	II(1)=I	GRID 25	1012
	II(3)=2*J	GRID 26	1013
	II(4)=J	GRID 27	1014
	II(5)=J	GRID 28	1015
	II(6)=J	GRID 29	1016
	II(7)=J	GRID 30	1017
	I=2*II(3)+II(4)+II(5)+II(6)+II(7)	GRID 31	1018
	II(2)=(KOR-I)/(II(1)+2)	GRID 32	1019
C	DENOMINATOR CONTAINS A 2 TO ALLOW FOR 2 SCRATCH ARRAYS, EACH OF	GRID 33	1020
C	LENGTH MAXDEG.	GRID 34	1021
	II(2)=MIN0(II(2),N-1)	GRID 35	1022
	MAXDEG=II(2)	GRID 36	1023
	RETURN	GRID 37	1024
C	SUBSTITUTE MAX IF NGRID TOO LARGE.	GRID 38	1025
40	N=MAX	GRID 39	1026
	WRITE(6,50) NGRID,N	GRID 40	1027
	50 FORMAT(23H1BANDIT WARNING MESSAGE/10X,6H\$GRID ,I10,5X,	GRID 41	1028
	+ 9HTOO LARGE /10X,6H\$GRID ,I10,5X,12H\$SUBSTITUTED.)	GRID 42	1029
	GO TO 20	GRID 43	1030
	END	GRID 44	1031
	SUBROUTINE READIT(A,IP,NIP)	READIT 2	1032
C	THIS ROUTINE READS AND STORES (IN IP) NUMERIC DATA APPEARING ON	READIT 3	1033
C	\$-CONTROL CARDS UP TO COLUMN 72.	READIT 4	1034
	DIMENSION ANUM(10)	READIT 5	1035
	DIMENSION A(1),IP(1)	READIT 6	1036
	DATA ANUM/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/	READIT 7	1037
C	INITIALIZE ARRAY.	READIT 8	1038
	NIP=0	READIT 9	1039
	DO 10 I=1,40	READIT10	1040
10	IP(I)=0	READIT11	1041
	I=3	READIT12	1042
	DO 70 KOUNT=1,40	READIT13	1043
	NUM=0	READIT14	1044
	NUMFL=0	READIT15	1045
20	I=I+1	READIT16	1046
	IF(I.LE.72) GO TO 30	READIT17	1047
	IF(NUMFL.EQ.1) GO TO 60	READIT18	1048
	RETURN	READIT19	1049
30	K=99	READIT20	1050
	DO 40 J=1,10	READIT21	1051
40	IF(A(I).EQ.ANUM(J)) K=J-1	READIT22	1052
	IF(K.NE.99) GO TO 50	READIT23	1053
	IF(NUMFL) 60,20,60	READIT24	1054
50	NUMFL=1	READIT25	1055
	NUM=10*NUM+K	READIT26	1056
	GO TO 20	READIT27	1057
60	NIP=KOUNT	READIT28	1058
	IP(NIP)=NUM	READIT29	1059
70	CONTINUE	READIT30	1060
	NIP=40	READIT31	1061
	RETURN	READIT32	1062
	END	READIT33	1063
	SUBROUTINE BOMBIT(IERR)	BOMBIT 2	1064
C	BOMB BANDIT TO SUPPRESS THE EXECUTION OF NASTRAN.	BOMBIT 3	1065
	COMMON /B/ IPARAM(20)	BOMBIT 4	1066
	COMMON /K/ II(7),KORE,IFL	BOMBIT 5	1067
	3 FORMAT(*-CURRENT FIELD LENGTH (FL) = *,06,*B*/	BOMBIT 6	1068
	+ * THIS BANDIT JOB MAY REQUIRE A LARGER FIELD LENGTH (FL)*/	BOMBIT 7	1069
	+ *-THEREFORE, MAKE THE FOLLOWING CHANGES*/	BOMBIT 8	1070
	+ * 1. INCREASE THE FL*/	BOMBIT 9	1071
	+ * 2. INSERT A NOREDUCE. CARD IMMEDIATELY BEFORE THE *,	BOMBIT10	1072
	+ *BANDIT. CARD*/	BOMBIT11	1073
	+ * 3. INSERT A \$GRID N CARD SOMEWHERE BEFORE THE BEGIN*,	BOMBIT12	1074
	+ * BULK CARD, WHERE THE INTEGER N IS AN UPPER BOUND (PREFERABLY*/	BOMBIT13	1075
	+ * LEAST UPPER BOUND) ON THE NUMBER OF GRID POINTS*)	BOMBIT14	1076
	5 FORMAT(200(1H+,130X/))	BOMBIT15	1077
	CALL REMARK(40H *****)	BOMBIT16	1078
	GO TO (10,20,30,40,50,60,70,80,90), IERR	BOMBIT17	1079
	EOF ENCOUNTERED.	BOMBIT18	1080
10	WRITE(6,12)	BOMBIT19	1081
12	FORMAT(55H1BANDIT FATAL ERROR - MISSING BEGIN BULK OR ENDDATA,	BOMBIT20	1082
	+ 6H CARD.)	BOMBIT21	1083
	CALL REMARK(39H **MISSING BEGIN BULK OR ENDDATA CARD)	BOMBIT22	1084
	GO TO 500	BOMBIT23	1085
C	BULK DATA CARD OUT OF SORT.	BOMBIT24	1086
20	CALL REMARK(31H **BULK DATA CARD OUT OF SORT)	BOMBIT25	1087
	GO TO 500	BOMBIT26	1088
C	SEQP CARDS IN DECK AND RESEQUENCING REQUESTED.	BOMBIT27	1089
30	CALL REMARK(32H **SEQP CARDS ALREADY IN DECK)	BOMBIT28	1090
	GO TO 500	BOMBIT29	1091
C	\$SCHEME ILLEGAL ARGUMENTS.	BOMBIT30	1092
40	WRITE(6,42)	BOMBIT31	1093
42	FORMAT(46H1BANDIT FATAL ERROR - ILLEGAL ARGUMENTS ON,	BOMBIT32	1094
	+ 14H \$SCHEME CARD.)	BOMBIT33	1095
	CALL REMARK(30H **ILLEGAL \$SCHEME ARGUMENTS)	BOMBIT34	1096
	GO TO 500	BOMBIT35	1097
C	TOO MANY TERMS IN MPC EQUATION.	BOMBIT36	1098
50	CALL REMARK(36H **MPC EQUATION HAS TOO MANY TERMS)	BOMBIT37	1099
	GO TO 500	BOMBIT38	1100

C MAXDEG EXCEEDED.	80MBIT39	1101
60 CALL REMARK(20H **MAXIMUM DEGREE EXCEEDED)	80MBIT40	1102
WRITE(6,3) IFL	80MBIT41	1103
GO TO 500	80MBIT42	1104
C MAXGRD EXCEEDED.	80MBIT43	1105
70 CALL REMARK(39H **MAX NUMBER OF GRID POINTS EXCEEDED)	80MBIT44	1106
WRITE(6,3) IFL	80MBIT45	1107
GO TO 500	80MBIT46	1108
C NON-EXISTENT GRID POINT REFERENCE ON \$-CARD	80MBIT47	1109
80 CALL REMARK(32H **ILLEGAL REFERENCE ON \$-CARD)	80MBIT48	1110
GO TO 500	80MBIT49	1111
C TOO MANY GRID POINTS ON \$-CARD.	80MBIT50	1112
90 WRITE(6,92)	80MBIT51	1113
92 FORMAT(51H1BANDIT FATAL ERROR - TOO MANY POINTS ON \$-CARD)	80MBIT52	1114
CALL REMARK(30H **TOO MANY POINTS ON \$-CARD)	80MBIT53	1115
GO TO 500	80MBIT54	1116
C ABORT BANDIT.	80MBIT55	1117
500 CALL REMARK(17H **BANDIT ABORT)	80MBIT56	1118
CALL REMARK(23H **NASTRAN SUPPRESSED)	80MBIT57	1119
CALL REMARK(40H *****)	80MBIT58	1120
WRITE(6,5)	80MBIT59	1121
CALL ABT	80MBIT65	1122
STOP	80MBIT66	1123
END	80MBIT67	1124
SUBROUTINE SCAT(KG,NCON,NEW,INV,II3,NORIG)	SCAT 2	1125
C THIS ROUTINE USES SCATTER SORT TECHNIQUES FOR EACH GRID POINT	SCAT 3	1126
C ENCOUNTERED TO DETERMINE WHETHER OR NOT THE POINT HAS	SCAT 4	1127
C BEEN SEEN BEFORE. IF NOT, INV, NORIG, AND NEW ARE UPDATED.	SCAT 5	1128
C INV(I,1) CONTAINS AN ORIGINAL GRID POINT NUMBER	SCAT 6	1129
C INV(I,2) CONTAINS THE INTERNAL NUMBER ASSIGNED TO IT (BEFORE SORTING)	SCAT 7	1130
DIMENSION INV(II3,2),NORIG(1)	SCAT 8	1131
COMMON /A/ MAXGRD,MAXDEG,KMOD	SCAT 9	1132
DIMENSION KG(1)	SCAT 10	1133
DO 100 I=1,NCON	SCAT 11	1134
NOLD=KG(I)	SCAT 12	1135
IF(NOLD.EQ.0)GO TO 100	SCAT 13	1136
LOC=NOLD-1	SCAT 14	1137
10 LOC=MOD(LOC,KMOD)+1	SCAT 15	1138
20 IF(INV(LOC,1).NE.0) GO TO 30	SCAT 16	1139
INV(LOC,1)=NOLD	SCAT 17	1140
NEW=NEW+1	SCAT 18	1141
IF(NEW.GT.MAXGRD) GO TO 150	SCAT 19	1142
NORIG(NEW)=NOLD	SCAT 20	1143
INV(LOC,2)=NEW	SCAT 21	1144
GO TO 40	SCAT 22	1145
30 IF(INV(LOC,1).NE.NOLD) GO TO 10	SCAT 23	1146
40 KG(I)=INV(LOC,2)	SCAT 24	1147
100 CONTINUE	SCAT 25	1148
RETURN	SCAT 26	1149
150 WRITE(6,160) MAXGRD	SCAT 27	1150
160 FORMAT(35H1 THIS STRUCTURE CONTAINS MORE THAN,I6,	SCAT 28	1151
+ 14H GRID POINTS. /14H FATAL ERROR.)	SCAT 29	1152
CALL BOMBIT(7)	SCAT 30	1153
END	SCAT 31	1154
SUBROUTINE BRIGIT(IG,II1,INV,II3,INT,ICC,NORIG,IP)	BRIGIT 2	1155
C THIS ROUTINE GENERATES A NEW INTERNAL/EXTERNAL CORRESPONDENCE	BRIGIT 3	1156
C TABLE NORIG AND CONNECTION TABLE IG SUCH THAT THE NEW INTERNAL	BRIGIT 4	1157
C NUMBERS CORRESPOND TO A SORT OF THE ORIGINAL NUMBERS INTO	BRIGIT 5	1158
C ASCENDING ORDER.	BRIGIT 6	1159
C INPUT - IG,INV,NORIG	BRIGIT 7	1160
C OUTPUT - IG,NORIG,ICC	BRIGIT 8	1161
C SCRATCH - INT,IP	BRIGIT 9	1162
DIMENSION IG(II1,1),INV(II3,2)	BRIGIT10	1163
DIMENSION INT(1),ICC(1),NORIG(1),IP(1)	BRIGIT11	1164
COMMON /S/ NN,MM,II,IB	BRIGIT12	1165
COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC	BRIGIT13	1166
COMMON /BITS/ NBITIN,NBITEX,IPASS	BRIGIT14	1167
REWIND 8	BRIGIT15	1168
C PERFORM A ROUGH SORT OF THE ORIGINAL GRID NUMBERS.	BRIGIT16	1169
L=0	BRIGIT17	1170
KFAC=-1	BRIGIT18	1171
20 KFAC=KFAC+1	BRIGIT19	1172
MIN=2147483647	BRIGIT20	1173
DO 50 I=1,KMOD	BRIGIT21	1174
IF(INV(I,1).GT.(KFAC*KMOD))	BRIGIT22	1175
+ MIN=MIN(MIN,INV(I,1))	BRIGIT23	1176
50 CONTINUE	BRIGIT24	1177
KFAC=(MIN-1)/KMOD	BRIGIT25	1178
DO 80 I=1,KMOD	BRIGIT26	1179
IS=INV(I,1)	BRIGIT27	1180
IF(IS.LE.(KFAC*KMOD).OR.IS.GT.(KFAC+1)*KMOD)GO TO 80	BRIGIT28	1181
L=L+1	BRIGIT29	1182
INT(L)=INV(I,1)	BRIGIT30	1183
80 CONTINUE	BRIGIT31	1184
IF(L.LT.NN)GO TO 20	BRIGIT32	1185
C COMPLETE THE SORTING OF THE ORIGINAL GRID NUMBERS.	BRIGIT33	1186
CALL SORT(INT,NN)	BRIGIT34	1187
C DETERMINE CORRESPONDENCE (ICC) BETWEEN NORIG AND INT ARRAYS.	BRIGIT35	1188
DO 130 I=1,NN	BRIGIT36	1189
L=INT(I)	BRIGIT37	1190
LOC=L-1	BRIGIT38	1191
110 LOC=MOD(LOC,KMOD)+1	BRIGIT39	1192
120 IF(INV(LOC,1).NE.L) GO TO 110	BRIGIT40	1193
M=INV(LOC,2)	BRIGIT41	1194
ICC(M)=I	BRIGIT42	1195
130 CONTINUE	BRIGIT43	1196
C TRANSFER INT ARRAY TO NORIG ARRAY.	BRIGIT44	1197
DO 220 I=1,NN	BRIGIT45	1198
220 NORIG(I)=INT(I)	BRIGIT46	1199
C CHANGE IG MATRIX ACCORDING TO CORRESPONDENCE TABLE ICC.	BRIGIT47	1200

CALL SWITCH(IG,II1,INT,ICC,IP(1),IP(MAXDEG+1))	BRIGIT48	1201
REWIND 8	BRIGIT49	1202
RETURN	BRIGIT50	1203
END	BRIGIT51	1204
SUBROUTINE SORT(LIST,NL)	SORT 2	1205
C THIS SUBROUTINE SORTS A LIST OF LENGTH NL AND IS BIASED TOWARDS THOSE	SORT 3	1206
C LISTS NOT BADLY OUT OF SORT.	SORT 4	1207
DIMENSION LIST(1)	SORT 5	1208
IF(NL.LE.1) RETURN	SORT 6	1209
NL1=NL-1	SORT 7	1210
DO 20 I=1,NL1	SORT 8	1211
K=NL-I	SORT 9	1212
KFLAG=0	SORT 10	1213
DO 10 J=1,K	SORT 11	1214
IF(LIST(J).LE.LIST(J+1)) GO TO 10	SORT 12	1215
KFLAG=1	SORT 13	1216
L=LIST(J)	SORT 14	1217
LIST(J)=LIST(J+1)	SORT 15	1218
LIST(J+1)=L	SORT 16	1219
10 CONTINUE	SORT 17	1220
IF(KFLAG.EQ.0) RETURN	SORT 18	1221
20 CONTINUE	SORT 19	1222
RETURN	SORT 20	1223
END	SORT 21	1224
SUBROUTINE SETIG(KG1,KG2,IG,II1,NORIG)	SETIG 2	1225
C THIS ROUTINE SETS IG(KG1,-)=KG2 AND IG(KG2,-)=KG1 IF THIS	SETIG 3	1226
C CONNECTION HAS NOT ALREADY BEEN SET.	SETIG 4	1227
DIMENSION IG(II1,1),NORIG(1)	SETIG 5	1228
COMMON /S/ NN,MM,IH,IB	SETIG 6	1229
COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC	SETIG 7	1230
COMMON /BITS/ NBITIN,NBITEX,IPASS	SETIG 8	1231
IF(KG1.EQ.0)RETURN	SETIG 9	1232
IF(KG2.EQ.0)RETURN	SETIG 10	1233
IF(KG1.EQ.KG2)RETURN	SETIG 11	1234
DO 50 LOOP=1,2	SETIG 12	1235
L=KG1	SETIG 13	1236
K=KG2	SETIG 14	1237
IF(LOOP.EQ.1) GO TO 20	SETIG 15	1238
L=KG2	SETIG 16	1239
K=KG1	SETIG 17	1240
20 M=0	SETIG 18	1241
30 M=M+1	SETIG 19	1242
IF(M.GT.MAXDEG) GO TO 60	SETIG 20	1243
IS=IUNPK(IG,MAXGRD*(M-1)+L,NBITIN)	SETIG 21	1244
IF(IS.EQ.0) GO TO 40	SETIG 22	1245
IF(IS.NE.K) GO TO 30	SETIG 23	1246
GO TO 50	SETIG 24	1247
40 CALL PACK(IG,MAXGRD*(M-1)+L,NBITIN,K)	SETIG 25	1248
MM=MAX0(MM,M)	SETIG 26	1249
50 CONTINUE	SETIG 27	1250
RETURN	SETIG 28	1251
60 WRITE(6,70) NORIG(L),MAXDEG	SETIG 29	1252
70 FORMAT(12H1 GRID POINT,I12,26H HAS DEGREE GREATER THAN,I6/	SETIG 30	1253
+ 14H FATAL ERROR.)	SETIG 31	1254
CALL BOMBIT(6)	SETIG 32	1255
END	SETIG 33	1256
SUBROUTINE TIGER(NEQ,IG,II1,LIST,NORIG)	TIGER 2	1257
C THIS ROUTINE MAKES ADDITIONS TO THE CONNECTION TABLE IG TO REFLECT	TIGER 3	1258
C THE PRESENCE OF MPC'S AND STORES THE DEPENDENT POINTS IN LIST.	TIGER 4	1259
C NEQ=NUMBER OF MPC EQUATIONS.	TIGER 5	1260
DIMENSION IG(II1,1),LIST(1),NORIG(1)	TIGER 6	1261
COMMON /S/ NN,MM,IH,IB	TIGER 7	1262
COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC	TIGER 8	1263
COMMON /BITS/ NBITIN,NBITEX,IPASS	TIGER 9	1264
DIMENSION KG(40)	TIGER 10	1265
IF(NEQ.EQ.0)RETURN	TIGER 11	1266
REWIND 11	TIGER 12	1267
C INITIALIZE LIST.	TIGER 13	1268
DO 20 I=1,NN	TIGER 14	1269
20 LIST(I)=0	TIGER 15	1270
C GENERATE NEW CONNECTIONS.	TIGER 16	1271
DO 100 II=1,NEQ	TIGER 17	1272
READ(11)KG	TIGER 18	1273
IGRID=KG(1)	TIGER 19	1274
LIST(IGRID)=IGRID	TIGER 20	1275
DO 100 I=1,MAXDEG	TIGER 21	1276
L=IUNPK(IG,MAXGRD*(I-1)+IGRID,NBITIN)	TIGER 22	1277
DO 100 J=2,NMPC	TIGER 23	1278
100 CALL SETIG(L,KG(J),IG,II1,NORIG)	TIGER 24	1279
REWIND 11	TIGER 25	1280
RETURN	TIGER 26	1281
END	TIGER 27	1282
SUBROUTINE SWITCH(IG,II1,IFLAG,KT,KA,KB)	SWITCH 2	1283
C THIS SUBROUTINE GENERATES A NEW IG MATRIX ACCORDING TO THE	SWITCH 3	1284
C CORRESPONDENCE TABLE KT, WHICH MUST BE SET UP	SWITCH 4	1285
C PRIOR TO THE CALL. ONLY INTERNAL NUMBERS ARE ALLOWED	SWITCH 5	1286
C AS VALUES OF KT.	SWITCH 6	1287
C	SWITCH 7	1288
C INPUT - IG,KT	SWITCH 8	1289
C OUTPUT - IG	SWITCH 9	1290
C SCRATCH - IFLAG,KA,KB	SWITCH10	1291
C	SWITCH11	1292
DIMENSION IG(II1,1),IFLAG(1),KT(1),KA(1),KB(1)	SWITCH12	1293
COMMON /S/ NN,MM,IH,IB	SWITCH13	1294
COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC	SWITCH14	1295
COMMON /BITS/ NBITIN,NBITEX,IPASS	SWITCH15	1296
C KT=CORRESPONDENCE TABLE. KT(OLD) = NEW.	SWITCH16	1297
C KA,KB = TEMPORARY STORAGE ROWS.	SWITCH17	1298
DO 100 I=1,NN	SWITCH18	1299
DO 90 J=1,MM	SWITCH19	1300

L=IUNPK(IG,MAXGRD*(J-1)+I,NBITIN)	SWITCH20	1301
IF(L.LE.0) GO TO 100	SWITCH21	1302
IS=KT(L)	SWITCH22	1303
CALL PACK(IG,MAXGRD*(J-1)+I,NBITIN,IS)	SWITCH23	1304
90 CONTINUE	SWITCH24	1305
100 CONTINUE	SWITCH25	1306
C INITIALIZE FLAGS.	SWITCH26	1307
DO 120 I=1,NN	SWITCH27	1308
120 IFLAG(I)=0	SWITCH28	1309
C INITIALIZE TEMPORARY STORAGE ROWS.	SWITCH29	1310
DO 130 I=1,MM	SWITCH30	1311
KA(I)=0	SWITCH31	1312
130 KB(I)=0	SWITCH32	1313
C RE-ORDER ROWS OF IG MATRIX.	SWITCH33	1314
DO 200 IROW=1,NN	SWITCH34	1315
IF(IFLAG(IROW).EQ.1) GO TO 200	SWITCH35	1316
IF(KY(IROW).EQ.IROW) GO TO 200	SWITCH36	1317
IFLAG(IROW)=1	SWITCH37	1318
DO 140 J=1,MM	SWITCH38	1319
140 KB(J)=IUNPK(IG,MAXGRD*(J-1)+IROW,NBITIN)	SWITCH39	1320
L=KT(IROW)	SWITCH40	1321
150 IFLAG(L)=1	SWITCH41	1322
DO 160 J=1,MM	SWITCH42	1323
KA(J)=IUNPK(IG,MAXGRD*(J-1)+L,NBITIN)	SWITCH43	1324
CALL PACK(IG,MAXGRD*(J-1)+L,NBITIN,KB(J))	SWITCH44	1325
160 KB(J)=KA(J)	SWITCH45	1326
M=KT(L)	SWITCH46	1327
IF(IFLAG(M).EQ.1) GO TO 170	SWITCH47	1328
L=M	SWITCH48	1329
GO TO 150	SWITCH49	1330
170 DO 180 J=1,MM	SWITCH50	1331
180 CALL PACK(IG,MAXGRD*(J-1)+M,NBITIN,KB(J))	SWITCH51	1332
200 CONTINUE	SWITCH52	1333
RETURN	SWITCH53	1334
END	SWITCH54	1335
SUBROUTINE MORRIS(LIST,NL,IG,II1)	MORRIS 2	1336
C THIS ROUTINE DELETES ALL REFERENCE IN THE CONNECTION TABLE IG	MORRIS 3	1337
C TO THOSE POINTS IN A LIST OF LENGTH NL.	MORRIS 4	1338
DIMENSION IG(II1,1),LIST(1)	MORRIS 5	1339
COMMON /S/ NN,MM	MORRIS 6	1340
COMMON /A/ MAXGRD	MORRIS 7	1341
COMMON /BITS/ NBITIN,NBITEX	MORRIS 8	1342
C COMPRESS OUT DUPLICATE ENTRIES IN LIST.	MORRIS 9	1343
CALL FIXIT(LIST,NL)	MORRIS10	1344
IF(NL.LE.0) RETURN	MORRIS11	1345
MM1=MM-1	MORRIS12	1346
DO 60 IJ=1,NL	MORRIS13	1347
I=LIST(IJ)	MORRIS14	1348
DO 50 J=1,MM	MORRIS15	1349
L=IUNPK(IG,MAXGRD*(J-1)+I,NBITIN)	MORRIS16	1350
IF(L.EQ.0) GO TO 60	MORRIS17	1351
K=0	MORRIS18	1352
20 K=K+1	MORRIS19	1353
M=IUNPK(IG,MAXGRD*(K-1)+L,NBITIN)	MORRIS20	1354
IF(M.NE.I) GO TO 20	MORRIS21	1355
IF(K.GE.MM) GO TO 40	MORRIS22	1356
DO 30 N=K,MM1	MORRIS23	1357
IS=IUNPK(IG,MAXGRD*N+L,NBITIN)	MORRIS24	1358
30 CALL PACK(IG,MAXGRD*(N-1)+L,NBITIN,IS)	MORRIS25	1359
40 CALL PACK(IG,MAXGRD*MM1+L,NBITIN,0)	MORRIS26	1360
CALL PACK(IG,MAXGRD*(J-1)+I,NBITIN,0)	MORRIS27	1361
50 CONTINUE	MORRIS28	1362
60 CONTINUE	MORRIS29	1363
RETURN	MORRIS30	1364
END	MORRIS31	1365
SUBROUTINE FIXIT(LIST,NL)	FIXIT 2	1366
C THIS ROUTINE COMPRESSES OUT ZEROES AND MULTIPLE ENTRIES IN A LIST	FIXIT 3	1367
C ORIGINALLY OF LENGTH NL. A CORRECTED LENGTH NL IS RETURNED TO	FIXIT 4	1368
C THE CALLING PROGRAM.	FIXIT 5	1369
DIMENSION LIST(1)	FIXIT 6	1370
IF(NL.LE.0) RETURN	FIXIT 7	1371
IF(NL.EQ.1) GO TO 110	FIXIT 8	1372
NL1=NL-1	FIXIT 9	1373
C DELETE DUPLICATE ENTRIES.	FIXIT 10	1374
DO 20 I=1,NL1	FIXIT 11	1375
IF(LIST(I).EQ.0) GO TO 20	FIXIT 12	1376
I1=I+1	FIXIT 13	1377
DO 10 J=I1,NL	FIXIT 14	1378
IF(LIST(I).NE.LIST(J)) GO TO 10	FIXIT 15	1379
LIST(I)=0	FIXIT 16	1380
GO TO 20	FIXIT 17	1381
10 CONTINUE	FIXIT 18	1382
20 CONTINUE	FIXIT 19	1383
C DELETE ZEROES.	FIXIT 20	1384
DO 40 I=1,NL1	FIXIT 21	1385
K=0	FIXIT 22	1386
25 IF(LIST(I).NE.0) GO TO 40	FIXIT 23	1387
K=K+1	FIXIT 24	1388
DO 30 J=I,NL1	FIXIT 25	1389
30 LIST(J)=LIST(J+1)	FIXIT 26	1390
LIST(NL)=0	FIXIT 27	1391
IF(K.GE.(NL-I+1)) GO TO 70	FIXIT 28	1392
GO TO 25	FIXIT 29	1393
40 CONTINUE	FIXIT 30	1394
C CALCULATE NEW LENGTH NL.	FIXIT 31	1395
70 DO 80 I=1,NL	FIXIT 32	1396
J=NL-I+1	FIXIT 33	1397
IF(LIST(J).NE.0) GO TO 90	FIXIT 34	1398
80 CONTINUE	FIXIT 35	1399
90 NL=NL-I+1	FIXIT 36	1400

RETURN	FIXIT 37	1401
110 IF (LIST(1).EQ.0) NL=0	FIXIT 38	1402
RETURN	FIXIT 39	1403
END	FIXIT 40	1404
SUBROUTINE SCHEME (NT, NUM, NOM, IO, IP, IG, II1, IC, IDEG, IDIS, IW,	SCHEME 2	1405
+ NEW, ICC, ILD, IPP)	SCHEME 3	1406
C IO IS VALID IFF 2.LE.IO.LE.3	SCHEME 4	1407
DIMENSION IG(II1,1), IC(1), IDEG(1), IDIS(1), IW(1)	SCHEME 5	1408
DIMENSION NEW(1), ICC(1), ILD(1), IPP(1)	SCHEME 6	1409
C IPP HAS DIMENSION 2*MAXDEG	SCHEME 7	1410
COMMON /S/ NN, MM, IH, IB	SCHEME 8	1411
COMMON /P/ IH0, IHE	SCHEME 9	1412
COMMON /A/ MAXGRD	SCHEME10	1413
COMMON /C/ IWARN, LINE, KORIG, KNEW	SCHEME11	1414
COMMON /BITS/ NBITIN, NBITEX, IPASS	SCHEME12	1415
COMMON /TIME/ STIME, NCM	SCHEME13	1416
COMMON /B/ IPARAM(20)	SCHEME14	1417
COMMON /DOL/ ISTART(100), IGNORE(100), IFIRST(100)	SCHEME15	1418
COMMON /DOLL/ IDIM, ISTA, IIG, IFIR	SCHEME16	1419
DIMENSION NODESL(100)	SCHEME17	1420
EQUIVALENCE (IH, ATIME)	SCHEME18	1421
C DETERMINE THE DEGREE OF EACH NODE.	SCHEME19	1422
CALL DEGREE (IG, II1, IDEG)	SCHEME20	1423
C DETERMINE MODD, THE MOST PREVALENT NODAL DEGREE.	SCHEME21	1424
MODD=MODE(IDEG, IPP)	SCHEME22	1425
C DETERMINE THE NUMBER OF COMPONENTS, NCM.	SCHEME23	1426
NCM=COMPNT(IG, II1, IC, IDEG, IW, ICC)	SCHEME24	1427
C DETERMINE THE MAXIMUM DEGREE OF ANY NODE.	SCHEME25	1428
MAXD=MAXDGR(0, IC, IDEG)	SCHEME26	1429
MM=MAXD	SCHEME27	1430
C DETERMINE THE ORIGINAL BANDWIDTH, IS.	SCHEME28	1431
DO 30 I=1, NN	SCHEME29	1432
NEW(I)=I	SCHEME30	1433
30 ILD(I)=I	SCHEME31	1434
IS=MAXBND(0, IG, II1, IC, IDEG, NEW, ILD)	SCHEME32	1435
KORIG=IS	SCHEME33	1436
IH0=IH	SCHEME34	1437
C INITIALIZE NEW AND ILD ARRAYS.	SCHEME35	1438
DO 35 I=1, NN	SCHEME36	1439
NEW(I)=0	SCHEME37	1440
35 ILD(I)=0	SCHEME38	1441
C IF IP IS NOT EQUAL TO 0, THEN PRINT COMPONENT NUMBER, DEGREE,	SCHEME39	1442
C AND CONNECTIONS FOR EACH NODE.	SCHEME40	1443
IF (IP.EQ.0) GO TO 31	SCHEME41	1444
C PRINT INTERNAL NUMBER CONNECTION TABLE.	SCHEME42	1445
DO 60 I=1, NN	SCHEME43	1446
IF (MOD(I, LINE).EQ.1) WRITE(6, 19)	SCHEME44	1447
19 FORMAT(37H1 LABEL COMP MDIST DEGR CONNECTIONS , 10X,	SCHEME45	1448
1 18H(INTERNAL NUMBERS))	SCHEME46	1449
MDIST=0	SCHEME47	1450
DO 65 J=1, MAXD	SCHEME48	1451
IS1=IUNPK(IG, MAXGRD*(J-1)+I, NBITIN)	SCHEME49	1452
IF (IS1.EQ.0) GO TO 65	SCHEME50	1453
MDIST=MAX0(MDIST, TABS(I-IS1))	SCHEME51	1454
65 CONTINUE	SCHEME52	1455
IPP(1)=IC(I)	SCHEME53	1456
IPP(2)=IDEG(I)	SCHEME54	1457
DO 610 IP1=1, MAXD	SCHEME55	1458
610 IPP(IP1+2)=IUNPK(IG, MAXGRD*(IP1-1)+I, NBITIN)	SCHEME56	1459
IS1=MAXD+2	SCHEME57	1460
60 WRITE(6, 61) I, IPP(1), MDIST, (IPP(J), J=2, IS1)	SCHEME58	1461
61 FORMAT(5I6, 20I5/ 25(25X, 21I5/))	SCHEME59	1462
WRITE(6, 700)	SCHEME60	1463
700 FORMAT(1H1, //, 32X, 31HPROGRAMMER INFORMATION MESSAGES //)	SCHEME61	1464
WRITE(6, 29) IS, IH	SCHEME62	1465
29 FORMAT(19H ORIGINAL BANDWIDTH, I7, 10H PROFILE, I10)	SCHEME63	1466
WRITE(6, 27) MODD	SCHEME64	1467
27 FORMAT(30H MODE OF DEGREE DISTRIBUTION =, I5)	SCHEME65	1468
IF (ISTA.LE.0) GO TO 31	SCHEME66	1469
WRITE(6, 701)	SCHEME67	1470
701 FORMAT(34H STARTING NODES SUPPLIED BY USER -)	SCHEME68	1471
WRITE(6, 100) (ISTART(I), I=1, ISTA)	SCHEME69	1472
C TEST TIMER.	SCHEME70	1473
31 CALL SECOND(TBEG)	SCHEME71	1474
IF (IO.EQ.3) IS=IH	SCHEME72	1475
C GENERATE NUMBERING SCHEME FOR EACH COMPONENT, NC.	SCHEME73	1476
DO 500 NC=1, NCM	SCHEME74	1477
C DETERMINE THE RANGE OF DEGREES (MI TO MAD) OF NODES OF INTEREST.	SCHEME75	1478
MI=MINDEG(NC, IC, IDEG)	SCHEME76	1479
MAD=MI	SCHEME77	1480
IF (NOM) 90, 87, 90	SCHEME78	1481
90 MA=MAXDGR(NC, IC, IDEG)	SCHEME79	1482
MAD=MI+((MA-MI)*NUM)/NOM	SCHEME80	1483
C MAKE SURE THAT MAD IS LESS THAN MODD.	SCHEME81	1484
MAD=MIN0(MAD, MODD-1)	SCHEME82	1485
MAD=MAX0(MAD, MI)	SCHEME83	1486
C DETERMINE BANDWIDTH OR SUM CRITERION FOR EACH NODE MEETING SPECI-	SCHEME84	1487
C FIED CONDITION.	SCHEME85	1488
87 IF (IP.EQ.0) GO TO 91	SCHEME86	1489
WRITE(6, 162) NC	SCHEME87	1490
162 FORMAT(22H ***** COMPONENT, I5, 12H *****)	SCHEME88	1491
IF (IO.EQ.2) WRITE(6, 169)	SCHEME89	1492
169 FORMAT(43H OPTION 2 SELECTED (CRITERION - BANDWIDTH ,	SCHEME90	1493
+ 57HMINIMIZATION; CONDITION - MINMAX NUMBER OF NODES/LEVEL))	SCHEME91	1494
IF (IO.EQ.3) WRITE(6, 179)	SCHEME92	1495
179 FORMAT(52H OPTION 3 SELECTED (CRITERION - MINIMIZATION OF SUM; ,	SCHEME93	1496
+ 44H CONDITION - MINMAX NUMBER OF NODES/LEVEL))	SCHEME94	1497
91 CALL DIAM(NC, MAD, NL, NODESL, MAXLEV, IG, II1, IC, IDEG, IDIS, IW, ICC)	SCHEME95	1498
IF (IP.EQ.0) GO TO 67	SCHEME96	1499
WRITE(6, 39) NC, MAD	SCHEME97	1500

WRITE(6,59) MAXLEV	SCHEME98	1501
WRITE(6,100) (NODESL(J),J=1,NL)	SCHEME99	1502
67 CONTINUE	SCHEME100	1503
IF(ISTA.LE.0) GO TO 760	SCHEME101	1504
M=0	SCHEME102	1505
DO 750 I=1,ISTA	SCHEME103	1506
J=ISTART(I)	SCHEME104	1507
IF(IC(J).NE.NC) GO TO 750	SCHEME105	1508
M=M+1	SCHEME106	1509
DO 755 K=1,99	SCHEME107	1510
L=101-K	SCHEME108	1511
755 NODESL(L)=NODESL(L-1)	SCHEME109	1512
NODESL(1)=J	SCHEME110	1513
750 CONTINUE	SCHEME111	1514
NL=MIN0(NL+M,100)	SCHEME112	1515
CALL FIXIT(NODESL,NL)	SCHEME113	1516
760 CONTINUE	SCHEME114	1517
IF(IP.EQ.0) GO TO 63	SCHEME115	1518
IF(ISTA.LE.0) GO TO 63	SCHEME116	1519
WRITE(6,730)	SCHEME117	1520
730 FORMAT(48H MERGED LIST OF STARTING NODES SUPPLIED BY USER ,	SCHEME118	1521
+ 15HAND BY BANDIT -)	SCHEME119	1522
WRITE(6,100) (NODESL(I),I=1,NL)	SCHEME120	1523
39 FORMAT(10H COMPONENT, I5,19H MAX DEGREE USED, I5)	SCHEME121	1524
59 FORMAT(52H STARTING NODES FOR MINMAX NUMBER OF NODES PER LEVEL, I5)	SCHEME122	1525
100 FORMAT(4X,20I5)	SCHEME123	1526
63 CONTINUE	SCHEME124	1527
JMAX=MIN0(NT,NL)	SCHEME125	1528
IM=900000000	SCHEME126	1529
IMM=IM	SCHEME127	1530
DO 400 J=1,JMAX	SCHEME128	1531
CALL RELABL(1,NODESL(J),IG,II1,IC,IDEG,IDIS,IW,NEW,ICC,ILD)	SCHEME129	1532
IB=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)	SCHEME130	1533
IF(IP.NE.0) WRITE(6,69) NODESL(J),IB,IM	SCHEME131	1534
69 FORMAT(14H STARTING NODE, I6,4X,9HBANDWIDTH, I6,3X,7HPROFILE, I8)	SCHEME132	1535
IF(IO.EQ.3) IB=IM	SCHEME133	1536
IE=ICC(NC+1)-1	SCHEME134	1537
IF(IM-IB) 400,350,300	SCHEME135	1538
300 IM=IB	SCHEME136	1539
IMM=IM	SCHEME137	1540
IJ=J	SCHEME138	1541
GO TO 400	SCHEME139	1542
350 IF(IMM.LE.IM) GO TO 400	SCHEME140	1543
IMM=IM	SCHEME141	1544
IJ=J	SCHEME142	1545
400 CONTINUE	SCHEME143	1546
CALL RELABL(1,NODESL(IJ),IG,II1,IC,IDEG,IDIS,IW,NEW,ICC,ILD)	SCHEME144	1547
500 CONTINUE	SCHEME145	1548
CALL STACK(IDEG,NEW,ILD,IW)	SCHEME146	1549
IB=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)	SCHEME147	1550
IF(IP.EQ.0) GO TO 710	SCHEME148	1551
WRITE(6,705)	SCHEME149	1552
705 FORMAT(21H ORIGINAL LABELING -)	SCHEME150	1553
WRITE(6,708) KORIG,IH0	SCHEME151	1554
WRITE(6,707)	SCHEME152	1555
707 FORMAT(21H STD CM RELABELING -)	SCHEME153	1556
WRITE(6,708) IB,IM	SCHEME154	1557
708 FORMAT(14H,26X,9HBANDWIDTH, I7,10X,7HPROFILE, I10)	SCHEME155	1558
709 FORMAT(21H REV CM RELABELING -)	SCHEME156	1559
710 IF(IO.EQ.3) IB=IM	SCHEME157	1560
C PROFILE = SUM CRIT	SCHEME158	1561
C IS=ORIGINAL BANDWIDTH (OR SUM CRIT IF IO.EQ.3)	SCHEME159	1562
C IB=CURRENT BANDWIDTH (OR SUM CRIT IF IO.EQ.3)	SCHEME160	1563
C IH=CURRENT PROFILE, IH0=ORIGINAL PROFILE	SCHEME161	1564
IF(IB-IS) 715,742,744	SCHEME162	1565
742 IF(IM.LT.IH0) GO TO 715	SCHEME163	1566
744 DO 712 I=1,NN	SCHEME164	1567
ILD(I)=I	SCHEME165	1568
712 NEW(I)=I	SCHEME166	1569
CALL STACK(IDEG,NEW,ILD,IW)	SCHEME167	1570
IB=IS	SCHEME168	1571
IM=IH0	SCHEME169	1572
IF(IP.EQ.0) GO TO 715	SCHEME170	1573
WRITE(6,713)	SCHEME171	1574
713 FORMAT(21H ORIG CM RELABELING -)	SCHEME172	1575
WRITE(6,708) IB,IM	SCHEME173	1576
715 IHE=IM	SCHEME174	1577
CALL REVERS(NEW,ILD)	SCHEME175	1578
IB=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)	SCHEME176	1579
IF(IP.EQ.0) GO TO 717	SCHEME177	1580
WRITE(6,709)	SCHEME178	1581
WRITE(6,708) IB,IM	SCHEME179	1582
717 IF(IM.LT.IHE) GO TO 720	SCHEME180	1583
CALL REVERS(NEW,ILD)	SCHEME181	1584
IB=MAXBND(0,IG,II1,IC,IDEG,NEW,ILD)	SCHEME182	1585
720 IHE=IM	SCHEME183	1586
KNEW=IB	SCHEME184	1587
IF(IP.EQ.0) GO TO 508	SCHEME185	1588
WRITE(6,722)	SCHEME186	1589
722 FORMAT(21H ** FINAL LABELING -)	SCHEME187	1590
WRITE(6,708) KNEW,IHE	SCHEME188	1591
508 CALL SECOND(ATIME)	SCHEME189	1592
ATIME=ATIME-TBEG	SCHEME190	1593
IF(IP.EQ.0) GO TO 600	SCHEME191	1594
WRITE(6,49) ATIME	SCHEME192	1595
89 FORMAT(7H TIME =,F9.3,6H SEC.)	SCHEME193	1596
600 RETURN	SCHEME194	1597
END	SCHEME195	1598
SUBROUTINE STACK(IDEG,NEW,ILD,IW)	STACK 2	1599
C STACK POINTS OF ZERO DEGREE AT END OF THE NUMBERING.	STACK 3	1600

DIMENSION IDEG(1),NEW(1),ILD(1),IW(1)	STACK 4	1601
C IW IS SCRATCH STORAGE.	STACK 5	1602
COMMON /S/ NN	STACK 6	1603
COMMON /ZERO/ KT	STACK 7	1604
KT=0	STACK 8	1605
NN1=NN-1	STACK 9	1606
C LIST POINTS OF ZERO DEGREE AND INCREMENT COUNTER KT.	STACK 10	1607
DO 10 I=1,NN	STACK 11	1608
IF(IDEG(I).GT.0) GO TO 10	STACK 12	1609
KT=KT+1	STACK 13	1610
IW(KT)=ILD(I)	STACK 14	1611
10 CONTINUE	STACK 15	1612
IF(KT.LE.0) GO TO 70	STACK 16	1613
C SORT LIST OF RENUMBERED NUMBERS TO BE STACKED.	STACK 17	1614
CALL SORT(IW,KT)	STACK 18	1615
C STACK POINTS OF ZERO DEGREE AT END OF NEW.	STACK 19	1616
DO 40 L=1,KT	STACK 20	1617
I=IW(L)-L+1	STACK 21	1618
K=NEW(I)	STACK 22	1619
IF(I.GE.NN) GO TO 30	STACK 23	1620
DO 20 J=I,NN1	STACK 24	1621
20 NEW(J)=NEW(J+1)	STACK 25	1622
30 NEW(NN)=K	STACK 26	1623
40 CONTINUE	STACK 27	1624
C CORRECT ILD, THE INVERSE OF NEW.	STACK 28	1625
70 DO 80 I=1,NN	STACK 29	1626
K=NEW(I)	STACK 30	1627
80 ILD(K)=I	STACK 31	1628
RETURN	STACK 32	1629
END	STACK 33	1630
SUBROUTINE REVERS(NEW,ILD)	REVERS 2	1631
C REVERSE THE NUMBERING OF THE FIRST NN-KT GRID POINTS.	REVERS 3	1632
C NN=NUMBER OF GRID POINTS.	REVERS 4	1633
C KT=THE NUMBER OF POINTS OF ZERO DEGREE (STACKED AT END OF NEW	REVERS 5	1634
C BY STACK)	REVERS 6	1635
DIMENSION NEW(1),ILD(1)	REVERS 7	1636
COMMON /S/ NN	REVERS 8	1637
COMMON /ZERO/ KT	REVERS 9	1638
C REVERSE NEW ARRAY.	REVERS10	1639
J=(NN-KT)/2	REVERS11	1640
LL=NN-KT+1	REVERS12	1641
DO 10 I=1,J	REVERS13	1642
L=LL-I	REVERS14	1643
K=NEW(L)	REVERS15	1644
NEW(L)=NEW(I)	REVERS16	1645
10 NEW(I)=K	REVERS17	1646
C CORRECT ILD, THE INVERSE OF NEW.	REVERS18	1647
DO 20 I=1,NN	REVERS19	1648
K=NEW(I)	REVERS20	1649
20 ILD(K)=I	REVERS21	1650
RETURN	REVERS22	1651
END	REVERS23	1652
SUBROUTINE DEGREE(IG,I1,IDEG)	DEGREE 2	1653
C SET UP THE IDEG ARRAY CONTAINING THE DEGREE OF EACH NODE STORED	DEGREE 3	1654
C IN THE IG ARRAY.	DEGREE 4	1655
C IDEG(I)=DEGREE OF NODE I	DEGREE 5	1656
DIMENSION IG(I1,1),IDEG(1)	DEGREE 6	1657
COMMON /S/ NN,MM,IH,IB	DEGREE 7	1658
COMMON /A/ MAXGRD	DEGREE 8	1659
COMMON /BITS/ NBITIN,NBITEX,IPASS	DEGREE 9	1660
DO 100 I=1,NN	DEGREE10	1661
IDEG(I)=0	DEGREE11	1662
DO 80 J=1,MM	DEGREE12	1663
IF(IUNPK(IG,MAXGRD*(J-1)+I,NBITIN)) 100,100,50	DEGREE13	1664
50 IDEG(I)=IDEG(I)+1	DEGREE14	1665
80 CONTINUE	DEGREE15	1666
100 CONTINUE	DEGREE16	1667
RETURN	DEGREE17	1668
END	DEGREE18	1669
FUNCTION MODE(IDEG,MODD)	MODE 2	1670
C COMPUTE MODE, THE MOST PREVALENT NODAL DEGREE. IF SEVERAL DEGREES	MODE 3	1671
C ARE EQUALLY PREVALENT, THE LOWEST IS CHOSEN.	MODE 4	1672
COMMON /S/ NN,MM	MODE 5	1673
DIMENSION IDEG(1),MODD(1)	MODE 6	1674
C IDEG(I)=DEGREE OF NODE I	MODE 7	1675
C MODD(I)=NUMBER OF NODES OF DEGREE I	MODE 8	1676
DO 10 I=1,MM	MODE 9	1677
10 MODD(I)=0	MODE 10	1678
DO 20 I=1,NN	MODE 11	1679
K=IDEG(I)	MODE 12	1680
20 MODD(K)=MODD(K)+1	MODE 13	1681
MODE=0	MODE 14	1682
MAX=0	MODE 15	1683
DO 30 I=1,MM	MODE 16	1684
K=MODD(I)	MODE 17	1685
IF(K.LE.MAX) GO TO 30	MODE 18	1686
MAX=K	MODE 19	1687
MODE=I	MODE 20	1688
30 CONTINUE	MODE 21	1689
RETURN	MODE 22	1690
END	MODE 23	1691
FUNCTION COMPNT(IG,I1,IC,IDEG,IW,ICC)	COMPNT 2	1692
C THIS FUNCTION HAS AS ITS VALUE THE NUMBER OF COMPONENTS STORED	COMPNT 3	1693
C IN THE CONNECTION ARRAY IG.	COMPNT 4	1694
C ALSO, IC AND ICC ARE SET UP.	COMPNT 5	1695
C IC(I)=COMPONENT INDEX FOR NODE I	COMPNT 6	1696
C ICC(I)=THE STARTING POSITION TO BE USED FOR LABELS IN COMPONENT I	COMPNT 7	1697
C THUS, ICC(I+1)-ICC(I)= THE NUMBER OF NODES IN COMPONENT I	COMPNT 8	1698
DIMENSION IG(I1,1),IC(1),IDEG(1),IW(1),ICC(1)	COMPNT 9	1699
COMMON /S/ NN,MM,IH,IB	COMPNT10	1700

COMMON /A/ MAXGRD	COMPNT11	1701
COMMON /BITS/ NBITIN,NBITEX,IPASS	COMPNT12	1702
C INITIALIZE ARRAYS.	COMPNT13	1703
DO 100 I=1,NN	COMPNT14	1704
ICC(I)=0	COMPNT15	1705
IC(I)=0	COMPNT16	1706
100 CONTINUE	COMPNT17	1707
NC=0	COMPNT18	1708
ICC(1)=1	COMPNT19	1709
C CHECK IF IC IS COMPLETE.	COMPNT20	1710
105 DO 110 I=1,NN	COMPNT21	1711
IF (IC(I)) 110,120,110	COMPNT22	1712
110 COMPNT=NC	COMPNT23	1713
RETURN	COMPNT24	1714
120 NC=NC+1	COMPNT25	1715
KI=0	COMPNT26	1716
KO=1	COMPNT27	1717
II(I)=I	COMPNT28	1718
IC(I)=NC	COMPNT29	1719
IF (NC-1) 130,125,125	COMPNT30	1720
125 IS=ICC(NC)+1	COMPNT31	1721
ICC(NC+1)=IS	COMPNT32	1722
130 KI=KI+1	COMPNT33	1723
II=II(KI)	COMPNT34	1724
M=IDEG(II)	COMPNT35	1725
IF (N) 140,105,140	COMPNT36	1726
140 DO 200 I=1,N	COMPNT37	1727
IA=IUNPK(IG,MAXGRD*(I-1)+II,NBITIN)	COMPNT38	1728
IF (IC(IA)) 200,150,200	COMPNT39	1729
150 IC(IA)=NC	COMPNT40	1730
KO=KO+1	COMPNT41	1731
II(KO)=IA	COMPNT42	1732
IS=ICC(NC+1)+1	COMPNT43	1733
ICC(NC+1)=IS	COMPNT44	1734
200 CONTINUE	COMPNT45	1735
IF (KO-KI) 105,105,130	COMPNT46	1736
END	COMPNT47	1737
FUNCTION MAXDGR(NC,IC,IDEG)	MAXDGR 2	1738
C THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DEGREE OF ANY NODE OF	MAXDGR 3	1739
C COMPONENT NC IF NC.GT.0	MAXDGR 4	1740
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.	MAXDGR 5	1741
DIMENSION IC(1),IDEG(1)	MAXDGR 6	1742
COMMON /S/ NN,MM,IH,IB	MAXDGR 7	1743
M=0	MAXDGR 8	1744
DO 100 I=1,NN	MAXDGR 9	1745
IF (NC) 40,50,40	MAXDGR10	1746
40 IF (IC(I)-NC) 100,50,100	MAXDGR11	1747
50 IF (IDEG(I)-M) 100,100,60	MAXDGR12	1748
60 M=IDEG(I)	MAXDGR13	1749
100 CONTINUE	MAXDGR14	1750
MAXDGR=M	MAXDGR15	1751
RETURN	MAXDGR16	1752
END	MAXDGR17	1753
FUNCTION MAXBND(NC,IG,II1,IC,IDEG,NEW,ILD)	MAXBND 2	1754
C THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DIFFERENCE BETWEEN NODE	MAXBND 3	1755
C LABELS OF CONNECTED NODES FOR NODES OF COMPONENT NC.GT.0	MAXBND 4	1756
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.	MAXBND 5	1757
C THE NODAL RENUMBERING DEFINED BY ILD AND NEW MUST BE SET UP PRIOR	MAXBND 6	1758
C TO THE FUNCTION CALL.	MAXBND 7	1759
C COMPUTE IH, THE SUM CRIT (PROFILE).	MAXBND 8	1760
DIMENSION IG(II1,1),IC(1),IDEG(1),NEW(1),ILD(1)	MAXBND 9	1761
COMMON /S/ NN,MM,IH,IB	MAXBND10	1762
COMMON /A/ MAXGRD	MAXBND11	1763
COMMON /BITS/ NBITIN,NBITEX,IPASS	MAXBND12	1764
IH=0	MAXBND13	1765
M=0	MAXBND14	1766
DO 100 I=1,NN	MAXBND15	1767
MX=0	MAXBND16	1768
IA=NEW(I)	MAXBND17	1769
IF (NC) 40,50,40	MAXBND18	1770
40 IF (IA.EQ.0) GO TO 100	MAXBND19	1771
IF (NC-IC(IA)) 100,50,100	MAXBND20	1772
50 N=IDEG(IA)	MAXBND21	1773
IF (N) 100,100,150	MAXBND22	1774
150 DO 90 J=1,N	MAXBND23	1775
II=IUNPK(IG,MAXGRD*(J-1)+IA,NBITIN)	MAXBND24	1776
IB=MAX(0,I-ILD(II))	MAXBND25	1777
IF (IB.GT.MX) MX=IB	MAXBND26	1778
90 CONTINUE	MAXBND27	1779
IF (MX.GT.M) M=MX	MAXBND28	1780
IH=IH+MX	MAXBND29	1781
100 CONTINUE	MAXBND30	1782
MAXBND=M	MAXBND31	1783
RETURN	MAXBND32	1784
END	MAXBND33	1785
FUNCTION MINDEG(NC,IC,IDEG)	MINDEG 2	1786
C THIS FUNCTION HAS AS ITS VALUE THE MINIMUM DEGREE OF ANY NODE OF	MINDEG 3	1787
C COMPONENT NC IF NC.GT.0	MINDEG 4	1788
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.	MINDEG 5	1789
DIMENSION IC(1),IDEG(1)	MINDEG 6	1790
COMMON /S/ NN,MM,IH,IB	MINDEG 7	1791
M=10000	MINDEG 8	1792
DO 100 I=1,NN	MINDEG 9	1793
IF (NC) 40,50,40	MINDEG10	1794
40 IF (IC(I)-NC) 100,50,100	MINDEG11	1795
50 IF (M-IDEG(I)) 100,100,60	MINDEG12	1796
60 M=IDEG(I)	MINDEG13	1797
100 CONTINUE	MINDEG14	1798
MINDEG=M	MINDEG15	1799
RETURN	MINDEG16	1800

```

      END
      SUBROUTINE DIAM(NC,MAXDEG,NL,NODESL,MAXLEV,
+ IG,II1,IC,IOEG,IDIS,IW,ICC)
C DETERMINE NL STARTING POINTS AND STORE IN NODESL.
      DIMENSION IG(II1,1),IDIS(1),IW(1),ICC(1),IC(1),IOEG(1)
      COMMON /S/ NN,MM,IH,IB
      COMMON /A/ MAXGRD
      COMMON /BITS/ NBITIN,NBITEX,IPASS
      DIMENSION NODESL(1)
      NL=0
      MAXLEV=10000
      DO 100 I=1,NN
        IF(NC-IC(I)) 100,40,100
        IF(MAXDEG-IOEG(I)) 100,105,105
40      MD=IDIS(I,ML,MAXLEV,IG,II1,IC,IOEG,IDIS,IW,ICC)
        IF(MD) 115,115,56
        56 IF(ML-MAXLFV)56,64,100
        58 MAXLEV=ML
        NL=NL+1
        NODESL(1)=I
        GO TO 100
        64 IF(NL.GE.100) GO TO 100
        NL=NL+1
        NODESL(NL)=I
100      CONTINUE
110      RETURN
115      ML=1
        NODESL(1)=I
        MAXLEV=0
        RETURN
      END
      SUBROUTINE RELABL(NS,NODES,IG,II1,IC,IOEG,IDIS,IW,NEW,ICC,ILO)
C GENERATE A RELABELING SCHEME STARTING WITH NS NODES FOR WHICH
C LABELS HAVE BEEN STORED IN ARRAY NODES.
C SET UP ILO AND NEW.
C ILO(OLD)=NEW
C NEW(NEW)=OLD, THE INVERSE OF ILO
      DIMENSION IG(II1,1),IC(1),IOEG(1),IDIS(1),IW(1),NEW(1),ICC(1)
      DIMENSION ILO(1)
      COMMON /S/ NN,MM,IH,IB
      INTEGER X
      COMMON /A/ MAXGRD
      COMMON /BITS/ NBITIN,NBITEX,IPASS
      DIMENSION NODES( 1),IAJ(50)
      I=NODES(1)
      ICN=IC(I)
      NT=ICC(ICN)-1
      DO 50 I=1,NN
        IF(IC(I)-ICN) 50,40,50
40      IDIS(I)=0
50      CONTINUE
      DO 100 J=1,NS
        JJ=NODES(J)
        IDIS(JJ)=-1
        JT=J+NT
        NEW(JT)=JJ
100      ILO(JJ)=JT
        KI=NT
        KO=NS+NT
        LL=KO
        L=1
        J=KO
        NNC=ICC(ICN+1)-1
130      KI=KI+1
        IF(KI-LL)135,132,135
132      L=L+1
        LL=KO+1
135      II=NEW(KI)
        N=IOEG(II)
        IF(N)140,255,140
140      IJ=0
        DO 200 I=1,N
          IA=IUNPK(IG,MAXGRD*(I-1)+II,NBITIN)
          IF(IDIS(IA)) 200,150,200
150      IJ=IJ+1
          IDIS(IA)=L
          KO=KO+1
          IAJ(IJ)=IA
          IW(IJ)=IOEG(IA)
200      CONTINUE
        IF(IJ-1)250,210,220
210      J=KO
          IZ=IAJ(1)
          NEW(KO)=IZ
          ILO(IZ)=KO
          GO TO 250
220      X=0
221      DO 230 I=2,IJ
        IF(IW(I)-IW(I-1))224,230,230
224      CONTINUE
        X=IW(I)
        IW(I)=IW(I-1)
        IW(I-1)=X
225      X=IAJ(I)
        IAJ(I)=IAJ(I-1)
        IAJ(I-1)=X
230      CONTINUE
        IF(X)235,235,220
235      DO 240 I=1,IJ
        J=J+1

```

```

      MINDEG17 1801
      DIAM 2 1802
      DIAM 3 1803
      DIAM 4 1804
      DIAM 5 1805
      DIAM 6 1806
      DIAM 7 1807
      DIAM 8 1808
      DIAM 9 1809
      DIAM 10 1810
      DIAM 11 1811
      DIAM 12 1812
      DIAM 13 1813
      DIAM 14 1814
      DIAM 15 1815
      DIAM 16 1816
      DIAM 17 1817
      DIAM 18 1818
      DIAM 19 1819
      DIAM 20 1820
      DIAM 21 1821
      DIAM 22 1822
      DIAM 23 1823
      DIAM 24 1824
      DIAM 25 1825
      DIAM 26 1826
      DIAM 27 1827
      DIAM 28 1828
      DIAM 29 1829
      DIAM 30 1830
      DIAM 31 1831
      RELABL 2 1832
      RELABL 3 1833
      RELABL 4 1834
      RELABL 5 1835
      RELABL 6 1836
      RELABL 7 1837
      RELABL 8 1838
      RELABL 9 1839
      RELABL10 1840
      RELABL11 1841
      RELABL12 1842
      RELABL13 1843
      RELABL14 1844
      RELABL15 1845
      RELABL16 1846
      RELABL17 1847
      RELABL18 1848
      RELABL19 1849
      RELABL20 1850
      RELABL21 1851
      RELABL22 1852
      RELABL23 1853
      RELABL24 1854
      RELABL25 1855
      RELABL26 1856
      RELABL27 1857
      RELABL28 1858
      RELABL29 1859
      RELABL30 1860
      RELABL31 1861
      RELABL32 1862
      RELABL33 1863
      RELABL34 1864
      RELABL35 1865
      RELABL36 1866
      RELABL37 1867
      RELABL38 1868
      RELABL39 1869
      RELABL40 1870
      RELABL41 1871
      RELABL42 1872
      RELABL43 1873
      RELABL44 1874
      RELABL45 1875
      RELABL46 1876
      RELABL47 1877
      RELABL48 1878
      RELABL49 1879
      RELABL50 1880
      RELABL51 1881
      RELABL52 1882
      RELABL53 1883
      RELABL54 1884
      RELABL55 1885
      RELABL56 1886
      RELABL57 1887
      RELABL58 1888
      RELABL59 1889
      RELABL60 1890
      RELABL61 1891
      RELABL62 1892
      RELABL63 1893
      RELABL64 1894
      RELABL65 1895
      RELABL66 1896
      RELABL67 1897
      RELABL68 1898
      RELABL69 1899
      RELABL70 1900

```


	IZ=IAJ(I)	RELABL71	1901
	NEW(J)=IZ	RELABL72	1902
	ILD(IZ)=J	RELABL73	1903
240	CONTINUE	RELABL74	1904
250	IF(KO-NNC)130,255,255	RELABL75	1905
255	CONTINUE	RELABL76	1906
	RETURN	RELABL77	1907
	END	RELABL78	1908
	FUNCTION IDIST(NS,ML,MAXLEV,IG,III,IC,IDEG,IOIS,IW,ICC)	IDIST 2	1909
C	THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DISTANCE OF ANY NODE	IDIST 3	1910
C	IN COMPONENT IC(NS) FROM THE NODE NS.	IDIST 4	1911
C	THE DISTANCE OF EACH NODE IN THIS COMPONENT IS STORED IN THE ARRAY	IDIST 5	1912
C	IOIS.	IDIST 6	1913
C	THE MAXIMUM NUMBER OF NODES AT THE SAME DISTANCE FROM NS IS	IDIST 7	1914
C	STORED IN ML.	IDIST 8	1915
	DIMENSION IG(III,1),IC(1),IDEG(1),IOIS(1),IW(1),ICC(1)	IDIST 9	1916
	COMMON /S/ NN,MH,IH,IB	IDIST 10	1917
	COMMON /A/ MAXGRD	IDIST 11	1918
	COMMON /BITS/ NBITIN,NBITEX,IPASS	IDIST 12	1919
	ICN=IC(NS)	IDIST 13	1920
	NNC=ICC(ICN+1)-ICC(ICN)	IDIST 14	1921
	DO 50 I=1,NN	IDIST 15	1922
	IF(IC(I)-IC(NS)) 50,40,50	IDIST 16	1923
40	IOIS(I)=0	IDIST 17	1924
50	CONTINUE	IDIST 18	1925
	LL=1	IDIST 19	1926
	L=0	IDIST 20	1927
	KI=0	IDIST 21	1928
	KQ=1	IDIST 22	1929
	ML=0	IDIST 23	1930
	IW(1)=NS	IDIST 24	1931
	IOIS(NS)=-1	IDIST 25	1932
130	KI=KI+1	IDIST 26	1933
	IF(KI-LL)135,132,135	IDIST 27	1934
132	L=L+1	IDIST 28	1935
	LL=KQ+1	IDIST 29	1936
	K=KQ-KI+1	IDIST 30	1937
	IF(K-ML) 135,135,133	IDIST 31	1938
133	ML=K	IDIST 32	1939
	IF(ML-MAXLEV) 135,135,220	IDIST 33	1940
135	II=IW(KI)	IDIST 34	1941
	N=IDEG(II)	IDIST 35	1942
	IF(N)140,215,140	IDIST 36	1943
140	DO 200 I=1,N	IDIST 37	1944
	IA=IUNPK(IG,MAXGRD*(I-1)+II,NBITIN)	IDIST 38	1945
	IF(IOIS(IA))200,150,200	IDIST 39	1946
150	IOIS(IA)=L	IDIST 40	1947
	KQ=KQ+1	IDIST 41	1948
	IW(KQ)=IA	IDIST 42	1949
200	CONTINUE	IDIST 43	1950
	IF(KQ-NNC)130,205,205	IDIST 44	1951
205	IDIST=L	IDIST 45	1952
	IOIS(NS)=0	IDIST 46	1953
	K=KQ-KI	IDIST 47	1954
	IF(K-ML) 206,206,207	IDIST 48	1955
207	ML=K	IDIST 49	1956
206	CONTINUE	IDIST 50	1957
	RETURN	IDIST 51	1958
215	L=0	IDIST 52	1959
	GO TO 205	IDIST 53	1960
220	IDIST=1	IDIST 54	1961
	RETURN	IDIST 55	1962
	END	IDIST 56	1963
	IDENT PCUP	PCUP 2	1964
	LIST D,M,A	PCUP 3	1965
	ENTRY PACK,IPACK,UNPK,IUNPK,ABT	PCUP 4	1966
	EXT CPC	PCUP 5	1967
	USE /BITS/	PCUP 6	1968
	BSS 2	PCUP 7	1969
IPASS	BSS 1	PCUP 8	1970
	USE 0	PCUP 9	1971
SIXTY	DATA 60.	PCUP 10	1972
PACK	BSSZ 1	PCUP 11	1973
IPACK	EQU PACK	PCUP 12	1974
	* SET FLAG TO INDICATE A PACK INSTRUCTION REQUIRED	PCUP 13	1975
	SB1 1	PCUP 14	1976
	* LOAD A0 WITH THE ADDRESS OF THE ARGUMENT LIST	PCUP 15	1977
INIT	SB7 A0	PCUP 16	1978
	SA0 A1	PCUP 17	1979
	* INCREASE ITERATION INDEX BY ONE	PCUP 18	1980
	SA5 IPASS	PCUP 19	1981
	SX6 1	PCUP 20	1982
	IX6 X5+X6	PCUP 21	1983
	SA6 A5+B0	PCUP 22	1984
	* LOAD X6 WITH THE ADDRESS OF ARGUMENT LIST FOR LATER LOADING OF	PCUP 23	1985
	* PACKED WORD	PCUP 24	1986
	BX6 X1	PCUP 25	1987
	* LOAD X1 WITH THE SUBSCRIPT OF THE ARR1Y	PCUP 26	1988
	SA1 A0+1	PCUP 27	1989
	SA1 X1	PCUP 28	1990
	* CONVERT SUBSCRIPT FROM INTEGER TO REAL	PCUP 29	1991
	PX1 00,X1	PCUP 30	1992
	NX1 X1	PCUP 31	1993
	* LOAD X2 WITH THE NUMBER OF BITS PER WORD	PCUP 32	1994
	SA2 SIXTY	PCUP 33	1995
	* LOAD X3 WITH THE NUMBER OF BITS TO BE DEVOTED TO EACH PACKED WORD	PCUP 34	1996
	SA3 A0+2	PCUP 35	1997
	SA3 X3	PCUP 36	1998
	* LOAD B6 WITH THE NUMBER OF BITS IN WORD NOT DEVOTED TO THE PACKED	PCUP 37	1999
	* WORD	PCUP 38	2000

SB6	X3-60	PCUP	39	2001
S96	-B6	PCUP	40	2002
* CONVERT THE NUMBER OF BITS PER PACKED WORD FROM INTEGER TO REAL		PCUP	41	2003
PX3	B0,X3	PCUP	42	2004
NX3	X3	PCUP	43	2005
* LOAD X2 WITH THE NUMBER OF PACKED WORDS THAT CAN EXIST PER 60 BIT		PCUP	44	2006
WORD		PCUP	45	2007
FX2	X2/X3	PCUP	46	2008
* TRUNCATE X2 TO LOSE ANY FRACTIONAL PART		PCUP	47	2009
UX2	B2,X2	PCUP	48	2010
LX2	B2,X2	PCUP	49	2011
PX2	B0,X2	PCUP	50	2012
NX2	X2	PCUP	51	2013
* LOAD X5 WITH THE NUMBER OF 60 BIT WORDS NECESSARY TO LOCATE THE		PCUP	52	2014
* POSITION IN ABSOLUTE CORE THAT THE VARIABLE ADDRESSED		PCUP	53	2015
FX5	X1/X2	PCUP	54	2016
* CONVERT X5 TO INTEGER BRIEFLY FOR AN INTEGER ADD OPERATION		PCUP	55	2017
UX5	B2,X5	PCUP	56	2018
LX5	B2,X5	PCUP	57	2019
* X6 NOW POINTS TO THE ABSOLUTE LOCATION IN CORE CONTAINING THE		PCUP	58	2020
* VARIABLE DESIRED		PCUP	59	2021
IX6	X5+X6	PCUP	60	2022
PX5	B0,X5	PCUP	61	2023
NX5	X5	PCUP	62	2024
* LOAD X4 WITH THE NUMBER OF WHOLE 60 BIT WORDS TO FIND THE LOCATION		PCUP	63	2025
* DESIRED		PCUP	64	2026
FX4	X2*X5	PCUP	65	2027
* X4 NOW CONTAINS OFFSET WITHIN THE LOCATION FOR PACKED VALUE		PCUP	66	2028
FX4	X1-X4	PCUP	67	2029
NX4	X4	PCUP	68	2030
* CONVERT X4 TO INTEGER BRIEFLY FOR COMPARISON PURPOSES		PCUP	69	2031
UX4	B2,X4	PCUP	70	2032
LX4	B2,X4	PCUP	71	2033
* SET X6 TO ITSELF - 1 FOR A ZERO X4 VALUE		PCUP	72	2034
* X4 = 0 INDICATES THAT THE PACKED VARIABLE ENDS ON A WORD BOUNDARY		PCUP	73	2035
NZ	X4,BR	PCUP	74	2036
SX6	X6-1	PCUP	75	2037
* LOAD X1 WITH THE NUMBER OF BITS TO BE SHIFTED		PCUP	76	2038
BR		PCUP	77	2039
PX4	B0,X4	PCUP	78	2040
NX4	X4	PCUP	79	2041
FX1	X3*X4	PCUP	80	2042
* CONVERT X1 TO INTEGER AND SAVE IN B2 FOR LATER USE		PCUP	81	2043
UX1	B2,X1	PCUP	82	2044
LX1	B2,X1	PCUP	83	2045
SB2	X1	PCUP	84	2046
* LOAD THE VARIABLE OF CORE CONCERNED		PCUP	85	2047
SA2	X6	PCUP	86	2048
* SHIFT THE WORD TO ALIGN PROPERLY FOR MASK		PCUP	87	2049
LX2	B2,X2	PCUP	88	2050
* COMPLEMENT B2		PCUP	89	2051
SB2	-B2	PCUP	90	2052
* FORM A 59 BIT MASK IN THE LOWER 59 BITS OF X4		PCUP	91	2053
MX4	59	PCUP	92	2054
LX4	59	PCUP	93	2055
* B2 NOW HAS THE NUMBER OF BITS PER PACKED WORD		PCUP	94	2056
SB2	B2+60	PCUP	95	2057
* LOAD X4 WITH A MASK OF 1'S WHOSE LENGTH EQUALS THE THIRD ARGUMENT - 1		PCUP	96	2058
AX4	B6,X4	PCUP	97	2059
SX5	1	PCUP	98	2060
* X6 HAS A MASK FOR SIGN AND VALUE		PCUP	99	2061
IX5	X4+X5	PCUP	100	2062
IX6	X4+X5	PCUP	101	2063
* +0 TO UPK IF AN UNPACK IS DESIRED		PCUP	102	2064
EQ	B1,UPK	PCUP	103	2065
* LOAD X1 WITH THE VALUE TO BE LOADED INTO CORE		PCUP	104	2066
SA1	A0+3	PCUP	105	2067
SA1	X1	PCUP	106	2068
* INSURE THAT VALUE IS NOT TOO LARGE FOR PROPER PACKING		PCUP	107	2069
BX0	X1	PCUP	108	2070
PL	X0,CHK	PCUP	109	2071
BX0	-X0	PCUP	110	2072
CHK		PCUP	111	2073
IX0	X0-X4	PCUP	112	2074
PL	X0,DMP	PCUP	113	2075
* IF VALUE IS NEGATIVE, SET SIGN MASK TO ZERO		PCUP	114	2076
NG	X1,SCH	PCUP	115	2077
SX5	B0	PCUP	116	2078
* AND OUT THE VALUE TO BE PACKED INTO X1		PCUP	117	2079
SCH	BX1	PCUP	118	2080
* OR THE SIG5 INTO X1		PCUP	119	2081
BX1	X1+X5	PCUP	120	2082
* COMPLEMENT X6		PCUP	121	2083
BX6	-X6	PCUP	122	2084
* ZERO OUT THE BITS INTO WHICH THE PACKED VALUE IS TO BE INSERTED		PCUP	123	2085
BX2	X2*X6	PCUP	124	2086
* OR THE PACKED VALUE INTO A 60 BIT WORD AT THE PROPER LOCATION		PCUP	125	2087
BX2	X1+X2	PCUP	126	2088
* SHIFT THE 60 BIT WORD TO REALIGN WITH CORE		PCUP	127	2089
LX6	B2,X2	PCUP	128	2090
* STORE THE 60 BIT PACKED WORD IN CORE		PCUP	129	2091
* THE FUNCTION RETURNS A 60 BIT PACKED VALUE		PCUP	130	2092
SA6	A2	PCUP	131	2093
* RESTORE A0		PCUP	132	2094
SA0	B7	PCUP	133	2095
* BRANCH OUT OF THE ROUTINE		PCUP	134	2096
ZR	PACK	PCUP	135	2097
UNPK	BSSZ	PCUP	136	2098
IUNPK	EQU	PCUP	137	2099
* SET FLAG TO INDICATE AN UNPACK INSTRUCTION IS DESIRED		PCUP	138	2100
SB1	B0			
ZR	INIT			

* OR THE 60 BIT WORD OF CORE TO REMOVE 1 PACKED VALUE INTO X6	PCUP 139	2101
UPK BX6 X2*X4	PCUP 140	2102
* OR A 60 BIT WORD TO REMOVE SIGN OF PACKED WORD INTO X5	PCUP 141	2103
BX5 X5*X2	PCUP 142	2104
* COMPLEMENT VALUE IF SIGN MASK INDICATES A NEGATIVE VALUE	PCUP 143	2105
ZR X5,SC	PCUP 144	2106
BX4 -X4	PCUP 145	2107
BX6 X4+X6	PCUP 146	2108
* RESTORE A0	PCUP 147	2109
SC SA0 B7	PCUP 148	2110
* BRANCH OUT OF THE ROUTINE	PCUP 149	2111
ZR UNPK	PCUP 150	2112
* GENERATE A DAYFILE MESSAGE AND ABORT JOB IF AN INTEGER TO BE	PCUP 151	2113
* PACKED IS TOO LARGE FOR THE SPECIFIED BIT PATTERN	PCUP 152	2114
PKHSS DATA C*VALUE TOO LARGE TO PACK*	PCUP 153	2115
DMP MESSAGE PKHSS,,1	PCUP 154	2116
AB ABORT	PCUP 155	2117
* ENTRY POINT TO ABORT JOB AND EXECUTE EXIT CONTROL CARDS.	PCUP 156	2118
ABT DATA 0	PCUP 157	2119
EQ AB	PCUP 158	2120
END	PCUP 159	2121
IDENT CORS	CORS 2	2122
ENTRY CORSIZ	CORS 3	2123
VFD 36/6MCORSIZ,24/0	CORS 4	2124
USE //	CORS 5	2125
A BSS 1	CORS 6	2126
USE /K/	CORS 7	2127
BSS 7	CORS 8	2128
KORE BSS 1	CORS 9	2129
CM BSS 1	CORS 10	2130
USE 0	CORS 11	2131
CORSIZ DATA 0	CORS 12	2132
MEMORY CM,STATUS,1	CORS 13	2133
SX0 18	CORS 14	2134
SA3 STATUS	CORS 15	2135
IX6 X3-X0	CORS 16	2136
LX6 30	CORS 17	2137
SA6 CM	CORS 18	2138
SX5 A	CORS 19	2139
IX6 X6-X5	CORS 20	2140
SA6 KORE	CORS 21	2141
EQ CORSIZ	CORS 22	2142
STATUS DATA 0	CORS 23	2143
END	CORS 24	2144

APPENDIX B **LISTING OF THE MACHINE-INDEPENDENT VERSION OF BANDIT**

C		BANDIT 5	1
C	B A N D I T	BANDIT 6	2
C		BANDIT 7	3
C	MAIN PROGRAM FOR THE RENUMBERING OF NASTRAN GRID POINTS FOR	BANDIT 8	4
C	REDUCED BANDWIDTH.	BANDIT 9	5
C	THE NASTRAN DATA DECK MUST CONTAIN A BEGIN BULK CARD IN ITS	BANDIT10	6
C	PROPER PLACE AND TERMINATE WITH AN ENDDATA CARD.	BANDIT11	7
	DIMENSION A(20)	BANDIT12	8
	COMMON K0M(25000)	JJ	9
	COMMON /S/ NN,MM,IH,IB	BANDIT14	10
	COMMON /P/ IH0,IHE	BANDIT15	11
	COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC	BANDIT16	12
	COMMON /B/ IPARAM(20),IARG(5)	BANDIT17	13
	COMMON /C/ INARN,LINE,KORIG,KNEW	BANDIT18	14
	COMMON /K/ II(7),K0KE,IFL	BANDIT19	15
	COMMON /BITS/ NBITIN,NBITEX,IPASS	BANDIT20	16
	COMMON /TIME/ STIME,NCOMP	BANDIT21	17
	COMMON /NEL/ NEL,TIM2	BANDIT22	18
	COMMON /JOL/ ISTART(100),IGNORE(100),IFIRST(100)	BANDIT23	19
	COMMON /DOLL/ IJIM,ISTA,IIG,IFIR,IGDEG,ISCH	BANDIT24	20
	COMMON /ZERO/ KT	BANDIT25	21
	COMMON /NG/ NGRID,CLOCK	BANDIT26	22
	INTEGER EOF	BANDIT27	23
	DATA BEGI,ENDJ,SEQG/4HDEGI,4HENUD,4HSE4G/	BANDIT28	24
C	SET NGRID DEFAULT.	BANDIT35	25
	KORE=25000	JJ	26
	NGRID = KORE/28	JJ	27
C	SET SCHEME DEFAULTS.	BANDIT38	28
	IARG(1)=80	BANDIT39	29
	IARG(2)=1	BANDIT40	30
	IARG(3)=2	BANDIT41	31
	IARG(4)=2	BANDIT42	32
	IARG(5)=0	BANDIT43	33
C	SET NUMBER OF BITS PER WORD FOR INTERNAL AND EXTERNAL	BANDIT44	34
C	GRID NUMBERS.	BANDIT45	35
	NBITIN=12	BANDIT46	36
	NBITEX=60	BANDIT47	37
	7 FORMAT(141,16(/),	BANDIT48	38
	1 36X,57H000000	AAAAA N N J00J00 IIIIII TTTTTT/BANDIT49	39
	2 36X,57H3	0 A A NN N J 0 I I /BANDIT50	40
	3 36X,57H1	0 A A N N N 0 0 I I /BANDIT51	41
	4 36X,57H000000	0 A A N N N 0 0 I I /BANDIT52	42
	5 36X,57H3	0 AAAAAA N NN J 0 I I /BANDIT53	43
	6 36X,57H3	0 A A N NN 0 0 I I /BANDIT54	44
	7 36X,57H000000	A A N N J00000 IIIIII T /BANDIT55	45
	8 FORMAT(22(/),48X,34HTHEORY OF STRUCTURES BRANCH - 1844 /	JJ	46
	1 46X,34HCOMPUTATION AND MATHEMATICS DEPARTMENT /	BANDIT57	47
	2 44X,42HNAVAL SHIP RESEARCH AND DEVELOPMENT CENTER /	BANDIT58	48
	3 53X,24HBLTHESUA, MARYLAND 20034)	BANDIT59	49
	9 FORMAT(/57X,	JJ	50
	+ 16HREV. 10 MAR 1972)	BANDIT61	51
	10 FORMAT(20A4)	BANDIT62	52
	11 FORMAT(14 ,20A4)	BANDIT63	53
	12 FORMAT(141)	BANDIT64	54
	13 FORMAT(///26H TOTAL CP TIME IN BANDIT ,F9.3,6H SEC.)	JJ	55
	LINE=55	BANDIT66	56
	KNEW=0	BANDIT67	57
	REWIND 8	BANDIT68	58
C	PRINT TITLE PAGE.	BANDIT69	59
	WRITE(6,7)	BANDIT70	60
	WRITE(6,8)	BANDIT71	61
	WRITE(6,9)	BANDIT72	62
C	INITIALIZE VARIABLES.	BANDIT73	63
	DO 15 J=1,20	BANDIT74	64
	15 IPARAM(J)=0	BANDIT75	65
	IPARAM(12)=4	BANDIT76	66
	IDIM=100	BANDIT77	67
	ISTA=0	BANDIT78	68
	IIG=0	BANDIT79	69
	ISCH=0	BANDIT80	70
	IFIR=0	BANDIT81	71
	IGDEG=0	BANDIT82	72
	DO 18 I=1,IDI4	BANDIT83	73
	ISTART(I)=0	BANDIT84	74
	IFIRST(I)=0	BANDIT85	75
	18 IGNORE(I)=0	BANDIT86	76
	IPASS=0	BANDIT87	77
	NN=0	BANDIT88	78
	MM=0	BANDIT89	79
	MAXGRJ=0	BANDIT90	80
	MAXDEG=0	BANDIT91	81
	KMOD=0	BANDIT92	82
	KORIG=0	BANDIT93	83
	KNEW=0	BANDIT94	84
	STIME=0.	BANDIT95	85
	NCOMP=0	BANDIT96	86
	NEL=0	BANDIT97	87
	KT=0	BANDIT98	88
	TIM2=0.	BANDIT99	89
	REWIND 9	BANDI100	90
C	READ DECK FOR FIRST TIME.	BANDI101	91
	CALL GOOGAN(1,2,5,9)	BANDI102	92
C	SLICE UP CORE ACCORDING TO SUBROUTINE GRID.	BANDI103	93
	K2=II(1)*II(2)+1	BANDI104	94
	K3=K2+II(3)*2	BANDI105	95
	K4=K3+II(4)	BANDI106	96
	K5=K4+II(5)	BANDI107	97
	K6=K5+II(6)	BANDI108	98
	K7=K6+II(7)	BANDI109	99
C	PROCESS DECK.	BANDI110	100

CALL NASNUM(KOM(1),II(1),KOM(K2),II(3),KOM(K3),KOM(K4),KOM(K5),	BANDI111	101
+ KOM(K6),KOM(K7),KOM(1),KOM(K2))	BANDI112	102
C ARRAY STARTING AT LOCATION K7 HAS DIMENSION 2*MAXDEG	BANDI113	103
C PROCESS OUTPUT ACCORDING TO OUTPUT REQUESTS.	BANDI114	104
C CHECK IF CONNECTION CARUS IN DECK.	BANDI115	105
IF(IPARAM(9).EQ.3)GO TO 19	BANDI116	106
REWIND 8	BANDI117	107
REWIND 9	BANDI118	108
FLAG=END0	BANDI119	109
J=0	BANDI120	110
K=9	BANDI121	111
GO TO 20	BANDI122	112
19 REWIND 8	BANDI123	113
J=0	BANDI124	114
K=8	BANDI125	115
FLAG=END0	BANDI126	116
IF(IPARAM(5).EQ.4)GO TO 20	BANDI127	117
K=9	BANDI128	118
IF(IPARAM(6).EQ.3)FLAG=3EGI	BANDI129	119
20 READ(K,10)A	BANDI130	120
IF(E0F(K).NE.0)CALL BOMBIT(1)	BANDI131	121
J=J+1	BANDI132	122
IF(IPARAM(10).EQ.5.AND.A(1).NE.SEQG) J=J-1	BANDI133	123
IF(MOD(J,LINE).EQ.1)WRITE(6,12)	BANDI134	124
IF(IPARAM(10).EQ.6) WRITE(6,11) A	BANDI135	125
IF(IPARAM(10).EQ.5.AND.A(1).EQ.SEQG) WRITE(6,11)A	BANDI136	126
IF(IPARAM(11).EQ.2)WRITE(7,10)A	BANDI137	127
IF(IPARAM(11).EQ.1.AND.A(1).EQ.SEQG) WRITE(7,10) A	BANDI138	128
IF(K.NE.3) WRITE(8,10) A	BANDI139	129
IF(A(1).NE.FLAG)GO TO 20	BANDI140	130
IF(FLAG.EQ.END0)GO TO 25	BANDI141	131
FLAG=EN0J	BANDI142	132
K=5	BANDI143	133
GO TO 20	BANDI144	134
25 CONTINUE	JJ	7
IF(IPARAM(5).EQ.3)GO TO 60	BANDI147	136
IF(IPARAM(7).EQ.4)GO TO 60	BANDI148	137
IF(IPARAM(9).EQ.4)GO TO 60	BANDI149	138
C USER SUMMARY.	BANDI150	139
WRITE(6,50) K0RIG,KNE4	JJ	8
50 FORMAT(23H1***BANDIT USER SUMMARY /	BANDI152	141
1 8X,25HORIGINAL SEMI-BANDWIDTH ,I9/	JJ	9
2 8X,20HNEW SEMI-BANDWIDTH ,I14)	JJ	10
WRITE(6,117) I0,IHE	BANDI150	144
117 FORMAT(8X,18HORIGINAL PROFILE ,I16/8X,13HNEW PROFILE ,I21)	JJ	11
WRITE(6,104) NM	BANDI158	146
WRITE(6,110) NEL	BANDI159	147
WRITE(6,112) NCOMP	BANDI160	148
WRITE(6,107) NM	BANDI161	149
107 FORMAT(8X,22HMAXIMUM NOOAL DEGREE ,I12)	JJ	12
WRITE(6,110) KT	BANDI163	151
I=IPARAM(1)	BANDI164	152
IF(I.EQ.1) WRITE(6,101)	BANDI165	153
IF(I.EQ.2) WRITE(6,102)	BANDI166	154
IF(I.EQ.3) WRITE(6,103)	BANDI167	155
101 FORMAT(8X,34HPUNCH OUTPUT SEQGP CARUS)	BANDI168	156
102 FORMAT(8X,34HPUNCH OUTPUT ALL CARUS)	BANDI169	157
103 FORMAT(8X,34HPUNCH OUTPUT NONE)	BANDI170	158
WRITE(6,105) MAXGRU,MAXDEG	BANDI172	159
105 FORMAT(18X,84HAXGRU ,I11/18X,8HMAXDEG ,I11)	JJ	13
111 FORMAT(8X,14HJATE AND TIME ,2A10)	BANDI177	161
C IPASS=NUMBER OF PUP CALLS.	BANDI178	162
104 FORMAT(8X,23HNUMBER OF GRID POINTS ,I11)	JJ	14
113 FORMAT(8X,20HNUMBER OF ELEMENTS ,I11)	JJ	15
112 FORMAT(8X,22HNUMBER OF COMPONENTS ,I12)	JJ	16
115 FORMAT(8X,23HNO. OF POINTS OF ZERO DEGREE ,I6)	JJ	17
GO TO 70	BANDI184	167
60 IF(IPARAM(10).EQ.5) WRITE(6,12)	BANDI185	168
70 CONTINUE	BANDI187	169
REWIND 8	BANDI188	170
IF(IPARAM(8).EQ.4) STOP 5	BANDI190	171
STOP	BANDI191	172
END	BANDI192	173
SUBROUTINE NASNUM(IG,II,INV,II3,INT,ICC,ILO,NORIG,IP,JU,JNV)	NASNUM 2	174
DIMENSION A(3),KG(40),LG(40),LINE(10),J(20),ATEMP(4)	NASNUM 3	175
DIMENSION IG(II,1),INV(II3,2),JG(1),JNV(1)	NASNUM 4	176
DIMENSION INT(1),ICC(1),ILJ(1),NORIG(1),IP(1)	NASNUM 5	177
C IP HAS DIMENSION 2*MAXDEG. JG AND JNV ARE EQUIV TO IG AND INV.	NASNUM 6	178
COMMON /S/ NM,MM,IM,I3	NASNUM 7	179
COMMON /A/ MAXGRU,MAXDEG,KMOD,NMPC	NASNUM 8	180
COMMON /B/ IPARAM(20),IARG(5)	NASNUM 9	181
COMMON /C/ IMAXN,NLINE,KORIG,KNEW	NASNUM10	182
COMMON /ITS/ NJITIN,NJITEX,IPASS	NASNUM11	183
COMMON /L/ II(7),KORE	NASNUM12	184
COMMON /TIME/ TIM2,NCOMP	NASNUM13	185
COMMON /NEL/ NEL	NASNUM14	186
COMMON /JOL/ ISTART(100),IGNORE(100),IFIRST(100)	NASNUM15	187
COMMON /JOLL/ IOIM,ISTA,IIIG,IFIX,IGDEG,ISCH	NASNUM16	188
C THE VARIABLE LINE DEFINED NEAR CARD NASNUM.300 IS NOT THE	NASNUM17	189
C SAME AS THE VARIABLE LINE APPEARING IN COMMON	NASNUM18	190
C IN OTHER ROUTINES.	NASNUM19	191
DIMENSION TYPE(50),ATYPE(50)	NASNUM20	192
DIMENSION F1A(2),F1JA(2),F1B(2),F10B(2)	NASNUM21	193
DATA JLG1,END0,SEQ6,4HDEGI,4HEND0,4HSEQG/	NASNUM22	194
DATA TYPE,4HCJAR,4HCELA,4HCELA,4HCONK,4HLQDH,4HCQDP,4HCQJA,	NASNUM23	195
1 4HCQUA,4HCQUA,4HCRJD,4HCSHE,4HCTRB,4HCTRI,4HCTRI,4HCTRM,	NASNUM24	196
2 4HCTRP,4HCTUB,4HCTWI,4HENDJ,4HMPD*,4HCDAM,4HCDAM,4HCDAS,	NASNUM25	197
3 4HCDAS,4HCDVIS,4HCDAM,4HCDAM,4HCELA,4HCDAS,4HCDAS,	NASNUM26	198
4 4HCDUJ,4HCTOR,4HCTRA,4HCTRI,4HCDAM,4HCDAM,4HCHTT,4HCIS3,	NASNUM27	199
5 4HCIS3,4HCIS2,4HCIS2,4HCISH,4HCISH,4HCFLU,4HCFLU,4HCFLU,	NASNUM28	200

6 4HCTET,4HCHEX,4HCHEX/ DATA TYPE/4H*,4HS1*,4HS2*,4H00*,4HEM*,4HLT*,4H01*,	NASNUM29	201
1 4HJ2*,4HU3*,4H*,4HAR*,4HSC*,4HA1*,4HA2*,4HEM*,	NASNUM30	202
2 4HLT*,4HE*,4HST*,4HATA,4H,4HP1*,4HP2*,4HS1*,	NASNUM31	203
3 4HS2*,4HU*,4HP3*,4HP4*,4HS3*,4HS4*,4HS5*,	NASNUM32	204
4 4HCAX*,4HJRG*,4HPRG*,4HARG*,4H1*,4H2*,4HRI2*,4H08*,	NASNUM33	205
5 4H020*,4H04*,4H08*,4H8*,4H16*,4H102*,4H103*,4H104*,	NASNUM34	206
6 4HA*,4HA1*,4HA2*/	NASNUM35	207
NTYPE=50	NASNUM36	208
REWINJ 8	NASNUM37	209
REWINJ 9	NASNUM38	210
NMPC=40	NASNUM39	211
KMOJ=2.*FLOAT(MAXGRD)-2.2/15*SQRT(1.131*FLOAT(MAXGRD))	NASNUM40	212
NEW=0	NASNUM41	213
IWARN=0	NASNUM42	214
NEQ=0	NASNUM43	215
2 FORMAT(29H13ANUIT INFORMATION MESSAGE - /	NASNUM44	216
+19H 40 GRID POINTS/	NASNUM45	217
+28H RESEQUENCING SUPPRESSED)	NASNUM46	218
4 FORMAT(19H ***NEW JANDWIDTH =,I6)	NASNUM47	219
5 FORMAT(35H1THE WRONG CARD FOLLOWS THIS CARD/1X,2A4,1P4E16.7,2A4//	NASNUM48	220
2 40H THE CONTINUATION CARD IS REQUIRED NEXT ,	NASNUM49	221
3 36H SINCCE BANJIT DOES NOT SORT THE DECK. /	NASNUM50	222
4 13H FATAL ERROR.)	NASNUM51	223
6 FORMAT(14H1)	NASNUM52	224
7 FORMAT(54H1 ONE OR MORE SEQGP CARDS ALREADY APPEAR IN DATA DECK./	NASNUM53	225
+ 55H RESEQUENCING CANNOT BE REQUESTED. FATAL ERROR.)	NASNUM54	226
8 FORMAT(54SEQGP,3X,2I8,56X)	NASNUM55	227
9 FORMAT(20A4)	NASNUM56	228
10 FORMAT(2A4,4F16.0,2A4)	NASNUM57	229
11 FORMAT(14,5(I8,11,7X))	NASNUM58	230
12 FORMAT(54SEQGP,3X,8I8,6X)	NASNUM59	231
14 FORMAT(///26H ***BANDIT WARNING MESSAGE /	NASNUM60	232
1 11X,35H1THE WRONG CARD MAY FOLLOW THIS CARD /	NASNUM61	233
2 11X,2A4,1P4E16.7,2A4/	NASNUM62	234
3 11X,47H1CHECK INPUT DECK TO BE SURE THAT A CONTINUATION ,	NASNUM63	235
4 42H 0A00 IS NEITHER MISSING NOR OUT OF SORT.)	NASNUM64	236
15 FORMAT(26H TOTAL CP TIME IN SCHEME = ,F9.3,6H SEC.)	NASNUM65	237
19 FORMAT(14H,5(20HINTERNAL ORIGINAL,6X))/	NASNUM66	238
11H,5(20GRID NO. GRID PT.,6X))	NASNUM67	239
C RETURN IF RESEQUENCING IS NOT DESIRED.	NASNUM68	240
IF(IPARAM(5).EQ.3)RETURN	NASNUM69	241
C CHECK IF SEQGP CARDS ALREADY APPEAR IN DECK.	NASNUM70	242
IF(IPARAM(7).EQ.3)GO TO 22	NASNUM71	243
C ABORT BANJIT SINCE SEQGP CARDS ALREADY APPEAR IN DECK.	NASNUM72	244
WRITE(6,7)	NASNUM73	245
CALL BOMBIT(3)	NASNUM74	246
C READ AND EXTRACT CONNECTION CARDS FROM DECK.	NASNUM75	247
22 CALL GOOGAN(2,1,9,8)	NASNUM76	248
REWINJ 8	NASNUM77	249
REWINJ 9	NASNUM78	250
C INITIALIZE EXPANDABLE CORE.	NASNUM79	251
DO 30 I=1,KORE	NASNUM80	252
30 JG(I)=0	NASNUM81	253
C READ CARD.	NASNUM82	254
40 READ(8,1J)F1A,(A(I),I=1,4),F10A	NASNUM83	255
C DETERMINE CARD TYPE.	NASNUM84	256
45 ITYPE=0	NASNUM85	257
DO 50 I=1,NTYPE	NASNUM86	258
50 IF(F1A(1).EQ.ITYPE(I).AND.F1A(2).EQ.WYPE(I)) ITYPE=I	NASNUM87	259
IF(ITYPE.EQ.0)GO TO 40	NASNUM88	260
IF(ITYPE.EQ.19)GO TO 50J	NASNUM89	261
IF(ITYPE.EQ.20.AND.IPARAM(4).EQ.3)GO TO 40	NASNUM90	262
C READ CONTINUATION TO CARD JUST READ.	NASNUM91	263
READ(8,1J)F1B,(A(I),I=5,8),F10B	NASNUM92	264
C CHECK EACH LOGICAL CARD FOR PROPER SORT.	NASNUM93	265
IF(F1B(1).EQ.F10A(1).AND.F1B(2).EQ.F10A(2)) GO TO 60	NASNUM94	266
C--- IF FOLLOWING CARD TYPES ARE OUT OF SORT, NO ERROR	NASNUM95	267
IF(ITYPE.EQ.1.OR.ITYPE.EQ.4)GO TO 56	NASNUM96	268
IF(ITYPE.EQ.32)GO TO 56	NASNUM97	269
IF(ITYPE.EQ.33)GO TO 56	NASNUM98	270
IF(ITYPE.EQ.35)GO TO 56	NASNUM99	271
IF(ITYPE.EQ.36)GO TO 56	NASNU100	272
IF(ITYPE.EQ.37)GO TO 56	NASNU101	273
IF(ITYPE.EQ.45.OR.ITYPE.EQ.46) GO TO 56	NASNU102	274
C--- IF FOLLOWING CARD TYPES ARE OUT OF SORT, POSSIBLE ERROR (GIVE	NASNU103	275
C--- WARNING MESSAGE)	NASNU104	276
IWARN=IWARN+1	NASNU105	277
IF(MOD(IWARN,6).EQ.1)WRITE(6,6)	NASNU106	278
IF(ITYPE.EQ. 2) GO TO 54	NASNU107	279
IF(ITYPE.EQ. 3) GO TO 54	NASNU108	280
IF(ITYPE.EQ.10) GO TO 54	NASNU109	281
IF(ITYPE.EQ.17) GO TO 54	NASNU110	282
IF(ITYPE.EQ.21.AND.ITYPE.LE.31)GO TO 54	NASNU111	283
C--- FOR OTHER CARD TYPES OUT OF SORT, ABORT BANDIT	NASNU112	284
52 WRITE(6,5)F1A,(A(I),I=1,4),F10A	NASNU113	285
CALL BOMBIT(2)	NASNU114	286
54 WRITE(6,14)F1A,(A(I),I=1,4),F10A	NASNU115	287
C SAVE CONTENTS OF THE SECOND CARD OF THE PAIR.	NASNU116	288
56 DO 58 I=1,4	NASNU117	289
ATEMP(I)=A(I+4)	NASNU118	290
58 A(I+4)=0.	NASNU119	291
C INITIALIZE K5 AND LG.	NASNU120	292
60 DO 70 I=1,NMPC	NASNU121	293
KG(I)=0	NASNU122	294
70 LG(I)=0	NASNU123	295
LOOP=1	NASNU124	296
NCON=4	NASNU125	297
C SET UP KG AND LG. **	NASNU126	298
GO TO (16J,220,220,200,120,120,120,120,120,180,120,140,140,	NASNU127	299
	NASNU128	300

1	14J,14J,140,180,12J,500,230,220,220,220,220,180,180,	NASNU129	301
2	18J,180,180,18J,18J,160,160,110,114,118,118,140,80,	NASNU130	302
3	85,120,90,80,95,200,114,110,120,90,90),IYPE	NASNU131	303
C* C13308,C1SH3		NASNU132	304
80 DO 81 I=1,7		NASNU133	305
81 KG(I)=A(I+1)+0.5		NASNU134	306
NCN=3		NASNU135	307
READ(8,1J) F1A,A(1),A(2),A(3),A(4),F10A		NASNU136	308
IF(F1A(1).NE.F10J(1).OR.F1A(2).NE.F10B(2)) GO TO 100		NASNU137	309
KG(8)=A(1)+0.5		NASNU138	310
GO TO 250		NASNU139	311
C* C133020		NASNU140	312
85 DO 86 I=1,7		NASNU141	313
86 KG(I)=A(I+1)+0.5		NASNU142	314
NCN=20		NASNU143	315
READ(8,1J) F1A,A(1),A(2),A(3),A(4),F10A		NASNU144	316
IF(F1A(1).NE.F10J(1).OR.F1A(2).NE.F10B(2)) GO TO 100		NASNU145	317
READ(8,10) F1B,A(5),A(6),A(7),A(8),F10B		NASNU146	318
IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52		NASNU147	319
DO 87 I=8,15		NASNU148	320
87 KG(I)=A(I-7)+0.5		NASNU149	321
READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A		NASNU150	322
IF(F1A(1).NE.F10J(1).OR.F1A(2).NE.F10B(2)) GO TO 100		NASNU151	323
READ(8,1J) F1B,A(5),A(6),A(7),A(8),F10B		NASNU152	324
IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52		NASNU153	325
DO 88 I=16,20		NASNU154	326
88 KG(I)=A(I-15)+0.5		NASNU155	327
GO TO 250		NASNU156	328
C* C13208,CHEXA2		NASNU157	329
90 DO 91 I=1,6		NASNU158	330
91 KG(I)=A(I+2)+0.5		NASNU159	331
NCN=8		NASNU160	332
READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A		NASNU161	333
IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100		NASNU162	334
DO 92 I=7,8		NASNU163	335
92 KG(I)=A(I-6)+0.5		NASNU164	336
GO TO 250		NASNU165	337
C* C1SH16		NASNU166	338
95 DO 96 I=1,7		NASNU167	339
96 KG(I)=A(I+1)+0.5		NASNU168	340
NCN=16		NASNU169	341
READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A		NASNU170	342
IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100		NASNU171	343
READ(8,10) F1B,A(5),A(6),A(7),A(8),F10B		NASNU172	344
IF(F1B(1).NE.F10A(1).OR.F1B(2).NE.F10A(2)) GO TO 52		NASNU173	345
DO 97 I=9,15		NASNU174	346
97 KG(I)=A(I-7)+0.5		NASNU175	347
READ(8,10) F1A,A(1),A(2),A(3),A(4),F10A		NASNU176	348
IF(F1A(1).NE.F10B(1).OR.F1A(2).NE.F10B(2)) GO TO 100		NASNU177	349
KG(16)=A(1)+0.5		NASNU178	350
GO TO 250		NASNU179	351
100 F1A(1)=F10J(1)		NASNU180	352
F1A(2)=F10J(2)		NASNU181	353
DO 101 I=1,4		NASNU182	354
101 A(I)=A(I+4)		NASNU183	355
F10A(1)=F10J(1)		NASNU184	356
F10A(2)=F10B(2)		NASNU185	357
GO TO 52		NASNU186	358
C* CTRAPRG,CFLUID4		NASNU187	359
110 DO 112 I=1,4		NASNU188	360
112 KG(I)=A(I+1)+0.5		NASNU189	361
GO TO 250		NASNU190	362
C* CTRIARG,CFLUID3		NASNU191	363
114 DO 116 I=1,3		NASNU192	364
116 KG(I)=A(I+1)+0.5		NASNU193	365
GO TO 250		NASNU194	366
C* CONM1, CONM2		NASNU195	367
113 KG(1)=A(2)+0.5		NASNU196	368
KG(2)=KG(1)		NASNU197	369
GO TO 250		NASNU198	370
C* CQJMEM,CQJPLT,CQJAD1,CQJAD2,CQJAD3,CSHEAR,CTWIST,CIS204,CTETRA		NASNU199	371
120 DO 130 I=1,4		NASNU200	372
130 KG(I)=A(I+2)+0.5		NASNU201	373
GO TO 250		NASNU202	374
C* CTRBSC,CTRIA1,CTRIA2,CTRMEM,CTRPLT,CHTRIZ		NASNU203	375
140 DO 150 I=1,3		NASNU204	376
150 KG(I)=A(I+2)+0.5		NASNU205	377
GO TO 250		NASNU206	378
C* C3AR,CCONEAX,CTORDR3		NASNU207	379
160 DO 170 I=1,2		NASNU208	380
170 KG(I)=A(I+2)+0.5		NASNU209	381
GO TO 250		NASNU210	382
C* CROD,CTUDE,CVISC,CQAMP3,CQAMP4,CELAS3,CELAS4,CMASS3,CMASS4		NASNU211	383
180 DO 190 I=1,2		NASNU212	384
KG(I)=A(I+2)+0.5		NASNU213	385
190 LG(I)=A(I+6)+0.5		NASNU214	386
C SET LOOP=2 SINCE 2 ELEMENTS MAY BE DEFINED ON ONE CARD.		NASNU215	387
LOOP=2		NASNU216	388
GO TO 250		NASNU217	389
C* CONROD,CFLUID2		NASNU218	390
200 DO 210 I=1,2		NASNU219	391
210 KG(I)=A(I+1)+0.5		NASNU220	392
GO TO 250		NASNU221	393
C* CELAS1,CELAS2,CQAMP1,CQAMP2,CMASS1,CMASS2		NASNU222	394
220 KG(1)=A(3)+0.5		NASNU223	395
KG(2)=A(5)+0.5		NASNU224	396
GO TO 250		NASNU225	397
C PROCESS MPC CARDS.		NASNU226	398
230 NCN=NMP2		NASNU227	399
KG(1)=A(2)+0.5		NASNU228	400

KG(2)=A(5)+0.5	NASNU229	401
I=2	NASNU230	402
240 READ(8,10)F1A,(A(J),J=1,4),F10A	NASNU231	403
IF(F10B(1).NE.F1A(1).OR.F10B(2).NE.F1A(2)) GO TO 250	NASNU232	404
I=I+1	NASNU233	405
IF(I.GT.NMPC)GO TO 245	NASNU234	406
F10B(1)=F10A(1)	NASNU235	407
F10B(2)=F10A(2)	NASNU236	408
KK=2	NASNU237	409
IF(MOD(I,2).EQ.0)KK=1	NASNU238	410
KG(I)=A(KK)+0.5	NASNU239	411
GO TO 240	NASNU240	412
245 WRITE(6,246) NMPC	NASNU241	413
246 FORMAT(36H1 AN MPC EQUATION CONTAINS MORE THAN,IS,6H TERMS./	NASNU242	414
+ 14H FATAL ERROR.)	NASNU243	415
CALL BOMBIT(5)	NASNU244	416
C PROCESS KG (AND LG IF LOOP=2) ARRAY.	NASNU245	417
250 DO 480 KK=1,LOOP	NASNU246	418
IF(KK.EQ.1)GO TO 300	NASNU247	419
DO 260 I=1,4	NASNU248	420
260 KG(I)=LG(I)	NASNU249	421
C SCATTER SEARCH AND CONVERT KG TO TEMPORARY SET OF INTERNAL NUMBERS.	NASNU250	422
300 CALL SCAT(KG,NCON,NEW,INV,II3,NORIG)	NASNU251	423
IF(ITYPE.NE.20)GO TO 420	NASNU252	424
C SAVE MPC GRID POINTS FOR LATER PROCESSING BY TIGER.	NASNU253	425
NEQ=NEQ+1	NASNU254	426
WRITE(11)KG	NASNU255	427
GO TO 45	NASNU256	428
C FILL CONNECTION TABLE ARRAY IG.	NASNU257	429
420 IEND=NCON-1	NASNU258	430
NEL=NEL+1	NASNU259	431
DO 450 I=1,IEND	NASNU260	432
L=I+1	NASNU261	433
DO 450 J=L,NCON	NASNU262	434
450 CALL SETIG(KG(I),KG(J),IG,II1,NORIG)	NASNU263	435
480 CONTINUE	NASNU264	436
IF(F1B(1).EQ.F10A(1).AND.F1B(2).EQ.F10A(2)) GO TO 40	NASNU265	437
IF(NCON.GE.8) GO TO 40	NASNU266	438
F1A(1)=F10(1)	NASNU267	439
F1A(2)=F10(2)	NASNU268	440
DO 495 I=1,4	NASNU269	441
495 A(I)=ATEMP(I)	NASNU270	442
F10A(1)=F10B(1)	NASNU271	443
F10A(2)=F10B(2)	NASNU272	444
GO TO 45	NASNU273	445
500 NN=NEW	NASNU274	446
IF(NEW.GT.0) GO TO 502	NASNU275	447
WRITE(6,2)	NASNU276	448
IPARAM(9)=4	NASNU277	449
RETURN	NASNU278	450
502 IF(IPARAM(4).EQ.3)GO TO 505	NASNU279	451
C MODIFY CONNECTION TABLE TO ACCOUNT FOR MPC EQUATIONS.	NASNU280	452
CALL TIGER(NEQ,IG,II1,ILO,NORIG)	NASNU281	453
NDEP=NN	NASNU282	454
CALL FIXIT(ILO,NDEP)	NASNU283	455
C GENERATE NEW IG AND NORIG ARRAYS.	NASNU284	456
505 CALL BRIGIT(IG,II1,INV,II3,INT,ICC,NORIG,IP)	NASNU285	457
C PRINT INTERNAL/EXTERNAL CORRESPONDENCE TABLE.	NASNU286	458
LEN=50	NASNU287	459
IF(IPARAM(10).EQ.5) GO TO 560	NASNU288	460
J=0	NASNU289	461
510 WRITE(6,19)	NASNU290	462
520 J=J+1	NASNU291	463
KEND=0	NASNU292	464
DO 530 K=1,9,2	NASNU293	465
L=J+LEN*(K-1)/2	NASNU294	466
LINE(K)=L	NASNU295	467
IF(L.GT.NEW) GO TO 550	NASNU296	468
KEND=K+1	NASNU297	469
530 LINE(K+1)=NORIG(L)	NASNU298	470
550 CONTINUE	NASNU299	471
IF(KEND.EQ.0)GO TO 560	NASNU300	472
WRITE(6,11) (LINE(K),K=1,KEND)	NASNU301	473
IF(MOD(J,LEN).NE.J)GO TO 520	NASNU302	474
J=J+4*LEN	NASNU303	475
IF(J.LT.NEW) GO TO 510	NASNU304	476
560 CONTINUE	NASNU305	477
C CONVERT ISTART,IGNORE,IFIRST FROM ORIGINAL TO INTERNAL NUMBERS.	NASNU306	478
I=ISTA+IIG+IFIR	NASNU307	479
IF(I.LE.0) GO TO 570	NASNU308	480
CALL FLIP(ISTART,ISTA,INV,II3,ICC)	NASNU309	481
CALL FLIP(IGNORE,IIG,INV,II3,ICC)	NASNU310	482
CALL FLIP(IFIRST,IFIR,INV,II3,ICC)	NASNU311	483
IF(IPARAM(10).EQ.5) GO TO 570	NASNU312	484
C PRINT INTERNAL NUMBERS FOR 3-CARDS.	NASNU313	485
WRITE(6,561)	NASNU314	486
561 FORMAT(30H1 3 CARDS (INTERNAL NUMBERS) /)	NASNU315	487
IF(ISTA.GT.0) WRITE(6,562) (ISTART(I),I=1,ISTA)	NASNU316	488
IF(IIG.GT.0) WRITE(6,564) (IGNORE(I),I=1,IIG)	NASNU317	489
IF(IFIR.GT.0) WRITE(6,566) (IFIRST(I),I=1,IFIR)	NASNU318	490
562 FORMAT(9H \$START ,20I5/100(9X,20I5/))	NASNU319	491
564 FORMAT(9H \$IGNORE ,20I5/100(9X,20I5/))	NASNU320	492
566 FORMAT(9H \$FIRST ,20I5/100(9X,20I5/))	NASNU321	493
570 CONTINUE	NASNU322	494
C SET UP LIST OF POINTS TO IGNORE IN INT ARRAY.	NASNU323	495
K=0	NASNU324	496
IF(IPARAM(4).EQ.3) GO TO 920	NASNU325	497
IF(NDEP.LE.0) GO TO 920	NASNU326	498
C MPC DEPENDENT POINTS FIRST.	NASNU327	499
DO 915 I=1,NDEP	NASNU328	500


```

J=ILD(I)
IF(J.LE.0) GO TO 915
K=K+1
INT(K)=ICG(J)
IF(K.GE.MAXGRD) CALL FIXIT(INT,K)
915 CONTINUE
920 IF(IGDEG.LE.0) GO TO 940
C GRID POINTS WITH DEGREE.GT.IGDEG SECOND.
IF(IGDEG.GE.MM) GO TO 940
CALL DEGREE(IG,II1,INV)
C HERE, INV(I)=DEGREE OF GRID POINT I
DO 930 I=1,NN
IF(JNV(I).LE.IGDEG) GO TO 930
K=K+1
INT(K)=I
IF(K.GE.MAXGRD) CALL FIXIT(INT,K)
930 CONTINUE
940 IF(IIIG.LE.0) GO TO 960
C $IGNORE POINTS THIRD.
DO 950 I=1,IIIG
J=IGNORE(I)
IF(J.LE.0) GO TO 950
K=K+1
INT(K)=J
IF(K.GE.MAXGRD) CALL FIXIT(INT,K)
950 CONTINUE
C K=NUMBER OF POINTS TO BE IGNORED BEFORE COMPRESSING LIST.
960 IF(K.LE.0) GO TO 970
C DELETE POINTS LISTED IN INT ARRAY FROM CONNECTION TABLE IG.
CALL MORRIS(INT,K,IG,II1)
970 CONTINUE
C RENUMBER NODES WITH SUBROUTINE SCHEME.
IF(IPARAM(10).EQ.6) IARG(5)=1
II8=II3/2
CALL SCHEME(IARG(1),IARG(2),IARG(3),IARG(4),IARG(5),IG,II1,
+ JNV(1),JNV(II8+1),JNV(2*II8+1),JNV(3*II8+1),INT,ICG,ILD,IP)
IF(IPARAM(10).EQ.5) GO TO 580
WRITE(6,4)IB
C WRITE NEW NASTRAN DATA DECK.
580 READ(9,9)B
WRITE(8,9)B
IF(B(1).NE.BEGI)GO TO 580
590 READ(9,9)B
IF(B(1).GE.SEQG.OR.B(1).EQ.5)GO TO 600
WRITE(8,9)B
GO TO 590
C WRITE SEQGP CARDS.
600 KREM=MOD(NEW,4)
IF(NEW.GE.4) GO TO 605
KBEG=1
GO TO 612
605 IEND=NEW-KREM-3
DO 610 K=1,IEND,4
L=K+3
610 WRITE(8,12) (NORIG(I),ILD(I),I=K,L)
IF(KREM.EQ.0)GO TO 620
KBEG=IEND+4
612 DO 615 I=KBEG,NEW
615 WRITE(8,8) NORIG(I),ILD(I)
C WRITE THE REMAINDER OF THE NASTRAN DECK.
620 WRITE(8,9)B
IF(B(1).EQ.ENOD)GO TO 730
READ(9,9)B
GO TO 620
700 CONTINUE
IF(IPARAM(10).EQ.5) GO TO 900
C PRINT ORIGINAL GRID POINT CONNECTION TABLE.
MAXD=MM
L=MAXD/11+1
L=LEN/L
705 FORMAT(10H1 GRID,5X,5H MAX,15X,13H*CONNECTIONS*,5X,
+ 23H(ORIGINAL GRID NUMBERS) /5X,
+ 20HPOINT COMP DIST. DEGR ,11(8X,1H*))
710 FORMAT(110,3I9,11I9/25(25X,11I9/))
DO 750 I=1,NN
IF(MOD(I,L).EQ.1) WRITE(6,705)
DO 720 J=1,MAXD
720 IP(J)=0
C CALCULATE MOIST AND PRINT TABLE.
MOIST=0
DO 725 J=1,MAXD
K=IG(I,J)
IF(K.EQ.0) GO TO 725
MOIST=MAXD(MOIST,IABS(I-K))
IP(J)=NORIG(K)
725 CONTINUE
K=NORIG(I)
IP1=INV(I,1)
IP2=INV(MAXGRD+I,1)
750 WRITE(6,710) K,IP1,MOIST,IP2,(IP(J),J=1,MAXD)
C PRINT CONNECTION TABLE FOR RENUMBERED NUMBERS.
DO 780 I=1,NEW
780 ICC(I)=ILD(I)
CALL SWITCH(IG,II1,INT,ICG,IP(1),IP(MAXDEG+1))
CALL DEGREE(IG,II1,JNV(II8+1))
L=CONPNT(IG,II1,JNV(1),JNV(II8+1),JNV(3*II8+1),ICG)
L=MAXD/26+1
L=LEN/L
805 FORMAT(37H1LABEL COMP MOIST DEGR CONNECTIONS ,10X,
+ 20H(RENUMBERED NUMBERS) )

```

```

NASNU329 501
NASNU330 502
NASNU331 503
NASNU332 504
NASNU333 505
NASNU334 506
NASNU335 507
NASNU336 508
NASNU337 509
NASNU338 510
NASNU339 511
NASNU340 512
NASNU341 513
NASNU342 514
NASNU343 515
NASNU344 516
NASNU345 517
NASNU346 518
NASNU347 519
NASNU348 520
NASNU349 521
NASNU350 522
NASNU351 523
NASNU352 524
NASNU353 525
NASNU354 526
NASNU355 527
NASNU356 528
NASNU357 529
NASNU358 530
NASNU359 531
NASNU360 532
NASNU361 533
NASNU362 534
NASNU364 535
NASNU365 536
NASNU368 537
NASNU370 538
NASNU371 539
NASNU372 540
NASNU373 541
NASNU374 542
NASNU375 543
NASNU376 544
NASNU377 545
NASNU378 546
NASNU379 547
NASNU380 548
NASNU381 549
NASNU382 550
NASNU383 551
NASNU384 552
NASNU385 553
NASNU386 554
NASNU387 555
NASNU388 556
NASNU389 557
NASNU390 558
NASNU391 559
NASNU392 560
NASNU393 561
NASNU394 562
NASNU395 563
NASNU396 564
NASNU397 565
NASNU398 566
NASNU399 567
NASNU400 568
NASNU401 569
NASNU402 570
NASNU403 571
NASNU404 572
NASNU405 573
NASNU406 574
NASNU407 575
NASNU408 576
NASNU409 577
NASNU410 578
NASNU411 579
NASNU412 580
NASNU413 581
NASNU414 582
NASNU415 583
NASNU416 584
NASNU417 585
NASNU418 586
NASNU419 587
NASNU420 588
NASNU421 589
NASNU422 590
NASNU423 591
NASNU424 592
NASNU425 593
NASNU426 594
NASNU427 595
NASNU428 596
NASNU429 597
NASNU430 598
NASNU431 599
NASNU432 600

```

```

810 FORMAT(5I6,20I5/ 25(25X,21I5/))
      DO 850 I=1,N
      IF(MOD(I,4).EQ.1) WRITE(6,805)
      DO 820 J=1,MAXD
820   IP(J)=0
      C CALCULATE MUIST AND PRINT TABLE.
      MUIST=0
      DO 825 J=1,MAXD
      K=IG(I,J)
      IF(K.EQ.0) GO TO 825
      MUIST=MAX0(MUIST,IABS(I-K))
      IP(J)=K
825   CONTINUE
      C INV(I,1)=IC(I) BEFORE PACKING
      C INV(MAXGRD+I,1)=IDEG(I) BEFORE PACKING
      IP1=INV(I,1)
      IP2=INV(MAXGRD+I,1)
850   WRITE(6,810) I,IP1,MUIST,IP2,(IP(J),J=1,MAXD)
900   RETURN
      END
      SUBROUTINE FLIP(LIST,N,INV,II3,ICC)
      C CONVERT 1-ARRAY LIST OF LENGTH N FROM ORIGINAL TO INTERNAL NUMBERS.
      COMMON /A/ MAXGRD,MAXDEG,KMOD
      DIMENSION LIST(1),INV(II3,2),ICC(1)
      C CHECK FOR DUPLICATE AND ZERO ENTRIES AND REDUCE N IF NECESSARY.
      CALL FIXIT(LIST,N)
      IF(N.LE.0) RETURN
      DO 20 I=1,N
      J=LIST(I)
      IF(J.LE.0) GO TO 30
      LOC=J-1
10   LOC=MOD(LOC,KMOD)+1
      IF(INV(LOC,1).EQ.0) GO TO 30
      IF(INV(LOC,1).NE.J) GO TO 10
      K=INV(LOC,2)
      LIST(I)=ICC(K)
20   CONTINUE
      RETURN
      C ADJUST BANJIT DUE TO ILLEGAL GRID POINT REFERENCE ON $-CONTROL CARD.
30   WRITE(6,40) J
40   FORMAT(11H10R10 POINT ,I10,30H APPEARING ON A $ CARD IS NOT
      + 25H A STRUCTURAL GRID POINT. /134 FATAL ERROR. )
      CALL JOMBIT(8)
      END
      SUBROUTINE GOOGAN(KA,KJ,NIN,NOUT)
      C THIS ROUTINE READS A NASTRAN DATA DECK AND RIGHT-ADJUSTS ALL
      C BULK DATA IN ITS FIELDS.
      C IN ADDITION, THE CALLING ARGUMENTS PROVIDE THE FOLLOWING OPTIONS -
      C KA=1, PROCESS ALL CARDS IN THE NASTRAN DATA DECK, OR
      C =2, PROCESS ONLY THOSE CARDS WITH A C OR G IN COLUMN 1,
      C MPC CARDS, AND THOSE CONTINUATION CARDS WITH ALL
      C NUMERIC FIELDS. THE ENDDATA CARD IS WRITTEN IN ANY CASE.
      C KB= 1, CONVERT ALL 8 COLUMN FIELDS TO 16 COLUMN FIELDS, OR
      C = 2, THE FIELD WIDTHS REMAIN UNCHANGED.
      C NIN = THE LOGICAL UNIT FROM WHICH THE INPUT DECK IS READ.
      C NOUT = THE LOGICAL UNIT ON WHICH THE OUTPUT IS WRITTEN.
      C NEITHER NIN NOR NOUT ARE REWOUND IN THIS ROUTINE.
      C IF AN ASTERISK APPLARS IN FIELD 1 AFTER THE MNEMONIC, IT IS LEFT-
      C ADJUSTED AGAINST THE MNEMONIC.
      C THE FOLLOWING TWO (2) CARDS ARE REQUIRED IN THE DATA DECK -
      C (1) A BEGIN BULK CARD TO INDICATE THE BEGINNING OF THE
      C BULK DATA DECK, AND
      C (2) AN ENDDATA CARD TO INDICATE THE END OF THE DATA DECK.
      C ALL CARDS PRECEDING THE BEGIN BULK CARD ARE WRITTEN ON NOUT IFF KA=1.
      DIMENSION ANUM(10)
      COMMON A(80),IP(40)
      COMMON IA,13,ICARJ,IFLAG,J,JNB,L,MKHOLJ,MKINSR,MKNIN
      COMMON NLANK,NFIELD,I,ICOL,IFIELD,IPROC,ITYPE
      COMMON K,KAST,KBLK,MKI,MKJ,NCOL,NIP,N
      COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC
      COMMON /3/ IPARAM(20),IARG(5)
      COMMON /JOL/ ISTART(100),IGNORE(100),IFIRST(100)
      COMMON /JOLL/ IDIM,ISTA,IIG,IFIR,IGDEG,ISCH
      COMMON /NG/ NGRID
      REAL M,N,II,LL,JJ,KK
      INTEGER EOF
      C DATA CARDS FOR ALPHABET (ALLOWS FOR FUTURE ADDITIONS TO
      C USER OPTION LIST).
      DATA J,C,D,E,G,M,N,P,1HB,1HC,1HD,1HE,1HF,1HG,1HH,1HN,1HP/
      DATA AA,II,LL,O,R,1HA,1HI,1HL,1HO,1HR/
      DATA 1,S,T,U,Y,1HU,1HS,1HT,1HU,1HY/
      DATA F,H,JJ,KK,1HF,1HH,1HJ,1HK/
      DATA V,W,X,Z,1HV,1HW,1HX,1HZ/
      DATA ASTER,PLUS,BLANK,DOLLAR,1H*,1H+,1H$,1H%
      DATA ANUM/1HO,1HI,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/
      DATA LFLAG/0/
      DATA IBOHB,IBOH/0,0/
      LFLAG=LFLAG+1
9   FORMAT(1H1)
10  FORMAT(80A1)
11  FORMAT(8A1,4(8X,8A1),3H*XZ,I5/3H*XZ,I5,4(8X,8A1),8A1)
      ICARD=0
      MKINSR=12
      MKNIN=NIN
      C READ EXECUTIVE OR CASE CONTROL CARD.
20  READ(NIN,10)A
      IF(EOF(NIN).EQ.0)GO TO 21
      IF(NIN.EQ.MKNIN)CALL JOMBIT(1)
      MKNIN=NIN
      NIN=MKINSR

```

```

NASNU433 601
NASNU434 602
NASNU435 603
NASNU436 604
NASNU437 605
NASNU438 606
NASNU439 607
NASNU440 608
JJ 19 609
NASNU442 610
NASNU443 611
NASNU444 612
NASNU445 613
NASNU446 614
NASNU447 615
NASNU448 616
NASNU449 617
NASNU450 618
NASNU451 619
NASNU452 620
FLIP 2 621
FLIP 3 622
FLIP 4 623
FLIP 5 624
FLIP 6 625
FLIP 7 626
FLIP 8 627
FLIP 9 628
FLIP 10 629
FLIP 11 630
FLIP 12 631
FLIP 13 632
FLIP 14 633
FLIP 15 634
FLIP 16 635
FLIP 17 636
FLIP 18 637
FLIP 19 638
FLIP 20 639
FLIP 21 640
FLIP 22 641
FLIP 23 642
FLIP 24 643
FLIP 25 644
GOOGAN 2 645
GOOGAN 3 646
GOOGAN 4 647
GOOGAN 5 648
GOOGAN 6 649
GOOGAN 7 650
GOOGAN 8 651
GOOGAN 9 652
GOOGAN10 653
GOOGAN11 654
GOOGAN12 655
GOOGAN13 656
GOOGAN14 657
GOOGAN15 658
GOOGAN16 659
GOOGAN17 660
GOOGAN18 661
GOOGAN19 662
GOOGAN20 663
GOOGAN21 664
GOOGAN22 665
GOOGAN23 666
GOOGAN24 667
GOOGAN25 668
GOOGAN26 669
GOOGAN27 670
GOOGAN28 671
GOOGAN29 672
GOOGAN30 673
GOOGAN31 674
GOOGAN32 675
GOOGAN33 676
GOOGAN34 677
GOOGAN35 678
GOOGAN36 679
GOOGAN37 680
GOOGAN38 681
GOOGAN39 682
GOOGAN40 683
GOOGAN41 684
GOOGAN42 685
GOOGAN43 686
GOOGAN44 687
GOOGAN45 688
GOOGAN46 689
GOOGAN47 690
GOOGAN48 691
GOOGAN49 692
GOOGAN50 693
GOOGAN51 694
GOOGAN52 695
GOOGAN53 696
GOOGAN54 697
GOOGAN55 698
GOOGAN56 699
GOOGAN57 700

```

MKINSR=MKHOLD	GOOGAN58	701
GO TO 20	GOOGAN59	702
21 IFLAG=0	GOOGAN60	703
ICARD=ICARD+1	GOOGAN61	704
C PROCESS OUTPUT OPTION CARD, IF PRESENT.	GOOGAN62	705
IF(A(1).NE.DOLLAR)GO TO 26	GOOGAN63	706
IF(ILEFLAG.GT.1) GO TO 29	GOOGAN64	707
C LOOK FOR FIRST KEYWORD.	GOOGAN65	708
ITYPE=0	GOOGAN66	709
IF(A(2).EQ.P.AND.A(3).EQ.U)ITYPE=1	GOOGAN67	710
IF(A(2).EQ.M.AND.A(3).EQ.P)ITYPE=4	GOOGAN68	711
IF(A(2).EQ.S.AND.A(3).EQ.E)ITYPE=5	GOOGAN69	712
IF(A(2).EQ.R.AND.A(3).EQ.II)ITYPE=6	GOOGAN70	713
IF(A(2).EQ.N.AND.A(3).EQ.AA)ITYPE=8	GOOGAN71	714
IF(A(2).EQ.P.AND.A(3).EQ.R)ITYPE=10	GOOGAN72	715
IF(A(2).EQ.S.AND.A(3).EQ.C)GO TO 1100	GOOGAN73	716
IF(A(2).EQ.S.AND.A(3).EQ.T) GO TO 1200	GOOGAN74	717
IF(A(2).EQ.U.AND.A(3).EQ.E) GO TO 1250	GOOGAN75	718
IF(A(2).EQ.F.AND.A(3).EQ.II) GO TO 1300	GOOGAN76	719
IF(A(2).EQ.II.AND.A(3).EQ.G) GO TO 1350	GOOGAN77	720
IF(A(2).EQ.G.AND.A(3).EQ.R) GO TO 1380	GOOGAN78	721
IF(A(2).EQ.AA.AND.A(3).EQ.T) ITYPE=12	GOOGAN79	722
IF(A(2).EQ.W.AND.A(3).EQ.AA) ITYPE=13	GOOGAN80	723
IF(A(2).NE.II.OR.A(3).NE.N)GO TO 1025	GOOGAN81	724
C INSERT CARDS FROM ALTERNATE FILE	GOOGAN82	725
IPARM(11)=1	GOOGAN83	726
MKHOLD=NIN	GOOGAN84	727
NIN=MKINSR	GOOGAN85	728
MKINSR=MKHOLD	GOOGAN86	729
DO 1021 MKI=2,80	GOOGAN87	730
MKJ=81-MKI	GOOGAN88	731
1021 A(MKJ+1)=A(MKJ)	GOOGAN89	732
IPARM(6)=4	GOOGAN90	733
1025 IF(ITYPE.EQ.0)GO TO 26	GOOGAN91	734
C LOOK FOR SECOND KEYWORD.	GOOGAN92	735
I=3	GOOGAN93	736
22 I=I+1	GOOGAN94	737
IF(I.GE.79)GO TO 26	GOOGAN95	738
IF(A(I).NE.BLANK)GO TO 22	GOOGAN96	739
24 I=I+1	GOOGAN97	740
IF(I.GE.99)GO TO 26	GOOGAN98	741
IF(A(I).EQ.BLANK)GO TO 24	GOOGAN99	742
J=0	GOOGA100	743
IF(A(I).EQ.S.AND.A(I+1).EQ.E)J=1	GOOGA101	744
IF(A(I).EQ.AA.AND.A(I+1).EQ.LL)J=2	GOOGA102	745
IF(A(I).EQ.N.AND.A(I+1).EQ.O)J=3	GOOGA103	746
IF(A(I).EQ.Y.AND.A(I+1).EQ.L)J=4	GOOGA104	747
IF(A(I).EQ.H.AND.A(I+1).EQ.II) J=5	GOOGA105	748
IF(A(I).EQ.H.AND.A(I+1).EQ.AA) J=6	GOOGA106	749
IF(J.EQ.0)GO TO 26	GOOGA107	750
C SET PARAMETER.	GOOGA108	751
IPARM(ITYPE)=J	GOOGA109	752
GO TO 26	GOOGA110	753
C READ \$SCHEME CARD.	GOOGA111	754
1100 CALL READIT(A,IP,NIP)	GOOGA112	755
ISCH=1	GOOGA113	756
I=MIN0(NIP,5)	GOOGA114	757
IF(I.EQ.0) GO TO 29	GOOGA115	758
DO 1110 J=1,I	GOOGA116	759
1110 IARG(J)=IP(J)	GOOGA117	760
GO TO 29	GOOGA118	761
C READ \$START CARD.	GOOGA119	762
1200 CALL READIT(A,IP,NIP)	GOOGA120	763
I=ISTA	GOOGA121	764
ISTA=ISTA+NIP	GOOGA122	765
IF(ISTA.LE.IDIM) GO TO 1205	GOOGA123	766
IBOM=2	GOOGA124	767
ISTA=IDIM	GOOGA125	768
GO TO 29	GOOGA126	769
1205 DO 1210 J=1,NIP	GOOGA127	770
1210 ISTART(I+J)=IP(J)	GOOGA128	771
GO TO 29	GOOGA129	772
C READ \$DEGREE CARD.	GOOGA130	773
1250 CALL READIT(A,IP,NIP)	GOOGA131	774
IGDEG=IP(1)	GOOGA132	775
GO TO 29	GOOGA133	776
C READ \$FIRST CARD.	GOOGA134	777
1300 CALL READIT(A,IP,NIP)	GOOGA135	778
I=IFIR	GOOGA136	779
IFIR=IFIR+NIP	GOOGA137	780
IF(IFIR.LE.IDIM) GO TO 1308	GOOGA138	781
IBOM=2	GOOGA139	782
IFIR=IDIM	GOOGA140	783
GO TO 29	GOOGA141	784
1308 DO 1310 J=1,NIP	GOOGA142	785
1310 IFIRST(I+J)=IP(J)	GOOGA143	786
GO TO 29	GOOGA144	787
C READ \$IGNORE CARD.	GOOGA145	788
1350 CALL READIT(A,IP,NIP)	GOOGA146	789
I=IIG	GOOGA147	790
IIG=IIG+NIP	GOOGA148	791
IF(IIG.LE.IDIM) GO TO 1360	GOOGA149	792
IBOM=2	GOOGA150	793
IIG=IDIM	GOOGA151	794
GO TO 29	GOOGA152	795
1360 DO 1365 J=1,NIP	GOOGA153	796
1365 IGNORE(I+J)=IP(J)	GOOGA154	797
GO TO 29	GOOGA155	798
C READ \$GRID CARD.	GOOGA156	799
1380 CALL READIT(A,IP,NIP)	GOOGA157	800

```

        NGRID=IP(1)
        GO TO 29
C LOOK FOR BEGIN BULK CARD.
26 I=0
27 I=I+1
        IF(I.GT.75)GO TO 29
        IF(A(I).EQ.BLANK)GO TO 27
        IF(A(I).NE.B)GO TO 29
        IF(A(I+1).NE.E)GO TO 29
        IF(A(I+2).NE.G)GO TO 29
        IF(A(I+3).NE.II)GO TO 29
        IFLAG=1
C LEFT-ADJUST BEGIN BULK CARD.
        K=73-I
        DO 28 J=1,72
            IF(J.LE.K)A(J)=A(J+I-1)
28 IF(J.GT.K)A(J)=BLANK
        IF(FLAG.GT.1) GO TO 29
C REJECT ILLEGAL PARAMETERS AND SET TO DEFAULTS.
        IF(IPARAM(1).NE.2.AND.IPARAM(1).NE.3) IPARAM(1)=1
        DO 1450 I=2,9
1450 IF(IPARAM(I).NE.4) IPARAM(I)=3
            IF(IPARAM(10).NE.6) IPARAM(10)=5
            IF(IPARAM(12).NE.3) IPARAM(12)=4
            IF(IPARAM(13).NE.4) IPARAM(13)=3
            CALL GRIG(NGRID)
            I=ISTA+IIG+IFIR+ISCH+IGJEG
            IF(I.LE.0) GO TO 29
C CHECK FOR ILLEGAL SCHEME ARGUMENTS.
        DO 1460 I=1,3
1460 IF(IARG(I).LT.1.OR.IARG(I).GT.MAXGRD) IBOMB=1
            IF(IARG(4).LT.2.OR.IARG(4).GT.3) IBOMB=1
            IF(IARG(5).LT.0.OR.IARG(5).GT.1) IBOMB=1
            WRITE(6,3)
            IF(ISCH.GT.0) WRITE(6,1500) (IARG(I),I=1,5)
1500 FORMAT(/,9H ISCH=,10I10/200(9X,10I10/))
            IF(ISTA.GT.0) WRITE(6,1505) (ISTART(I),I=1,ISTA)
1505 FORMAT(/,9H ISTART,10I10/200(9X,10I10/))
            IF(IGJEG.GT.0) WRITE(6,1510) IGJEG
1510 FORMAT(/,9H IGJEG=,10I10/200(9X,10I10/))
            IF(IFIR.GT.0) WRITE(6,1515) (IFIRST(I),I=1,IFIR)
1515 FORMAT(/,9H IFIRST,10I10/200(9X,10I10/))
            IF(IG.GT.0) WRITE(6,1520) (IGNORE(I),I=1,IIG)
1520 FORMAT(/,9H IGNORE,10I10/200(9X,10I10/))
            IF(IBOMB.EQ.1) CALL BOMBIT(4)
            IF(IBOMB.EQ.2) CALL BOMBIT(9)
29 IF(KA.EQ.1) WRITE(6OUT,10)A
            IF(IFLAG.EQ.1)GO TO 20
C RETURN IF RIGHT-ADJUSTING OF CARDS IS NOT NEEDED.
        IF(IPARAM(5).EQ.3.AND.IPARAM(6).EQ.3)RETURN
C READ BULK DATA CARD.
30 READ(NIN,10)A
        IF(EOF(NIN).EQ.0)GO TO 31
        IF(NIN.EJ.MKNIN) CALL BOMBIT(1)
C SWITCH INPUT FILES
        MKHOLD=NIN
        NIN=MKNIN
        MKINS=MKHOLD
        GO TO 30
31 ICARD=ICARD+1
C LEFT-ADJUST FIRST FILE.
        DO 1600 I=1,4
1600 IF(A(I).NE.BLANK) GO TO 1610
        CONTINUE
        GO TO 30
1610 IF(I.EQ.1) GO TO 1650
        J=I-1
        K=8-J
        DO 1620 I=1,K
1620 A(I+J)=BLANK
1650 CONTINUE
C LOOK FOR SEQSP CARD.
        IF(A(1).EQ.S.AND.A(2).EQ.E.AND.A(3).EQ.Q.AND.A(4).EQ.G)IPARAM(7)=4
C LOOK FOR COMMENT CARD.
        IF(A(1).EQ.DOLLAR.AND.KA.EQ.1)GO TO 35
C LOOK FOR ENDATA CARD.
        I=0
32 I=I+1
        IF(I.GT.75)GO TO 35
        IF(A(I).EQ.BLANK)GO TO 32
        IF(A(I).NE.E)GO TO 40
        IF(A(I+1).NE.N)GO TO 40
        IF(A(I+2).NE.O)GO TO 40
        IF(A(I+3).NE.J)GO TO 40
C LEFT-ADJUST ENDATA CARD.
        K=73-I
        DO 33 J=1,72
            IF(J.LE.K)A(J)=A(J+I-1)
33 IF(J.GT.K)A(J)=BLANK
            WRITE(6OUT,10)A
            RETURN
35 WRITE(6OUT,10)A
        GO TO 30
C DETERMINE IF CARD IS TO BE PROCESSED.
40 IF(KA.EQ.1)GO TO 150
        IF(A(1).EQ.C.O.K.A(1).EQ.G)GO TO 150
        IF(A(1).EQ.M.AND.A(2).EQ.P)GO TO 150
        NCOL=3
        IF(A(1).EQ.ASTER)GO TO 50

```

```

GOOGA158 801
GOOGA159 802
GOOGA160 803
GOOGA161 804
GOOGA162 805
GOOGA163 806
GOOGA164 807
GOOGA165 808
GOOGA166 809
GOOGA167 810
GOOGA168 811
GOOGA169 812
GOOGA170 813
GOOGA171 814
GOOGA172 815
GOOGA173 816
GOOGA174 817
GOOGA175 818
GOOGA176 819
GOOGA177 820
GOOGA178 821
GOOGA179 822
GOOGA180 823
GOOGA181 824
GOOGA182 825
GOOGA183 826
GOOGA184 827
GOOGA185 828
GOOGA186 829
GOOGA187 830
GOOGA188 831
GOOGA189 832
GOOGA190 833
GOOGA191 834
GOOGA192 835
GOOGA193 836
GOOGA194 837
GOOGA195 838
GOOGA196 839
GOOGA197 840
GOOGA198 841
GOOGA199 842
GOOGA200 843
GOOGA201 844
GOOGA202 845
GOOGA203 846
GOOGA204 847
GOOGA205 848
GOOGA206 849
GOOGA207 850
GOOGA208 851
GOOGA209 852
GOOGA210 853
GOOGA211 854
GOOGA212 855
GOOGA213 856
GOOGA214 857
GOOGA215 858
GOOGA216 859
GOOGA217 860
GOOGA218 861
GOOGA219 862
GOOGA220 863
GOOGA221 864
GOOGA222 865
GOOGA223 866
GOOGA224 867
GOOGA225 868
GOOGA226 869
GOOGA227 870
GOOGA228 871
GOOGA229 872
GOOGA230 873
GOOGA231 874
GOOGA232 875
GOOGA233 876
GOOGA234 877
GOOGA235 878
GOOGA236 879
GOOGA237 880
GOOGA238 881
GOOGA239 882
GOOGA240 883
GOOGA241 884
GOOGA242 885
GOOGA243 886
GOOGA244 887
GOOGA245 888
GOOGA246 889
GOOGA247 890
GOOGA248 891
GOOGA249 892
GOOGA250 893
GOOGA251 894
GOOGA252 895
GOOGA253 896
GOOGA254 897
GOOGA255 898
GOOGA256 899
GOOGA257 900

```

```

      IF(A(1).EQ.PLUS)GO TO 60
      GO TO 30
50  NCOL=16
60  NFIELD=64/NCOL
      I=0
70  I=I+1
      IF(I.GT.NFIELD)GO TO 150
      IPROC=0
      IFLAG=0
      J=0
80  J=J+1
      IF(IPROC.EQ.1)GO TO 70
      IF(J.LE.NCOL)GO TO 90
      IF(IFLAG.EQ.1)GO TO 30
      GO TO 70
90  ICOL=8+NCOL*(I-1)+J
      IF(A(ICOL).EQ.BLANK)GO TO 80
      IFLAG=1
      DO 100 L=1,10
100 IF(A(ICOL).EQ.ANUM(L))IPROC=1
      GO TO 80
C PROCESS FIRST FIELD.
150 NCOL=8
      KAST=8
      KBLK=8
      DO 160 I=1,8
      IF(A(I).NE.BLANK.AND.A(I).NE.ASTER.AND.A(I+1).EQ.BLANK)KBLK=I+1
      IF(A(I).EQ.ASTER)KAST=I
160 IF(A(I).EQ.ASTER)NCOL=16
      IF(A(1).EQ.PLUS)NCOL=8
      IF(NCOL.EQ.16)GO TO 170
      IF(KBLK.EQ.2)GO TO 200
      IF(A(1).NE.PLUS)A(KBLK)=ASTER
      IF(A(1).EQ.PLUS)A(1)=ASTER
      GO TO 200
170 IF(A(1).EQ.ASTER)GO TO 200
      IA=MIN0(KAST,KBLK)
      ID=MAX0(KAST,KBLK)
      A(ID)=BLANK
      A(IA)=ASTER
C RIGHT-ADJUST ALL 9ULK DATA WHICH IS TO BE PROCESSED.
200 NFIELD=64/NCOL
      IFIELD=0
210 IFIELD=IFIELD+1
      IF(IFIELD.GT.NFIELD)GO TO 300
      I=0
220 I=I+1
      IF(I.GT.NCOL)GO TO 210
      ICOL=9+NCOL*IFIELD-I
      IF(A(ICOL).EQ.BLANK)GO TO 220
      NBLANK=I-1
      NN=NCOL-NBLANK
      DO 230 I=1,NCOL
      J=9+NCOL*IFIELD-I
      JNB=J-NBLANK
      IF(I.LE.NN)A(J)=A(JNB)
      IF(I.GT.NN)A(J)=BLANK
230 CONTINUE
      GO TO 210
C WRITE NEW CARD.
300 IF(KBLK.EQ.1) A(73)=ASTER
      IF(NCOL.EQ.8.AND.KBLK.EQ.1)GO TO 310
      WRITE(NOUT,10)A
      GO TO 30
310 WRITE(NOUT,11) (A(I),I=1,40),ICARD,ICARD, (A(I),I=41,80)
      GO TO 30
      END
      SUBROUTINE GRID(NGRID)
C PARTITION EXPANDABLE CORE.
      COMMON /IIS/ NBITIN,NBITEX
      COMMON /A/ MAXGRD,MAXDEG
      COMMON /K/ II(7),KOR
      MAX=16384
      N=NGRID
      NBITIN = 60
      IF(N.LT.100) N=100
      IF(N.GT.MAX) GO TO 40
C CALCULATE WIDTH II(2) OF IG MATRIX.
20  L=60/NBITIN
      M=60/NBITEX
      N=N+L*M-1
      N=N-MOD(N,L*M)
      MAXGRD=N
C I=PACKED LENGTH FOR INTERNAL NUMBER.
C J=PACKED LENGTH FOR ORIGINAL NUMBER.
      I=N/L
      J=N/M
C SET UP DIMENSIONS IN II ARRAY, WHERE IG(II1,II2),INV(II3,2),
C INT(II4),ICG(II5),ILO(II6),NORIG(II7)
      II(1)=1
      II(3)=2*J
      II(4)=J
      II(5)=J
      II(6)=J
      II(7)=J
      I=2*II(3)+II(4)+II(5)+II(6)+II(7)
      II(2)=(KOR-I)/(II(1)+2)
C DENOMINATOR CONTAINS A 2 TO ALLOW FOR 2 SLATCH ARRAYS, EACH OF
C LENGTH MAXDEG.
      II(2)=PI40(II(2),N-1)

```

```

GOOGA258 901
GOOGA259 902
GOOGA260 903
GOOGA261 904
GOOGA262 905
GOOGA263 906
GOOGA264 907
GOOGA265 908
GOOGA266 909
GOOGA267 910
GOOGA268 911
GOOGA269 912
GOOGA270 913
GOOGA271 914
GOOGA272 915
GOOGA273 916
GOOGA274 917
GOOGA275 918
GOOGA276 919
GOOGA277 920
GOOGA278 921
GOOGA279 922
GOOGA280 923
GOOGA281 924
GOOGA282 925
GOOGA283 926
GOOGA284 927
GOOGA285 928
GOOGA286 929
GOOGA287 930
GOOGA288 931
GOOGA289 932
GOOGA290 933
GOOGA291 934
GOOGA292 935
GOOGA293 936
GOOGA294 937
GOOGA295 938
GOOGA296 939
GOOGA297 940
GOOGA298 941
GOOGA299 942
GOOGA300 943
GOOGA301 944
GOOGA302 945
GOOGA303 946
GOOGA304 947
GOOGA305 948
GOOGA306 949
GOOGA307 950
GOOGA308 951
GOOGA309 952
GOOGA310 953
GOOGA311 954
GOOGA312 955
GOOGA313 956
GOOGA314 957
GOOGA315 958
GOOGA316 959
GOOGA317 960
GOOGA318 961
GOOGA319 962
GOOGA320 963
GOOGA321 964
GOOGA322 965
GOOGA323 966
GOOGA324 967
GRID 2 968
GRID 3 969
GRID 4 970
GRID 5 971
GRID 6 972
GRID 7 973
GRID 8 974
JJ 20 975
GRID 11 976
GRID 12 977
GRID 13 978
GRID 14 979
GRID 15 980
GRID 16 981
GRID 17 982
GRID 18 983
GRID 19 984
GRID 20 985
GRID 21 986
GRID 22 987
GRID 23 988
GRID 24 989
GRID 25 990
GRID 26 991
GRID 27 992
GRID 28 993
GRID 29 994
GRID 30 995
GRID 31 996
GRID 32 997
GRID 33 998
GRID 34 999
GRID 35 1000

```

MAXDEG=II(2)	GRID 36	1001
RETURN	GRID 37	1002
C SUBSTITUTE MAX IF NGRID TOO LARGE.	GRID 38	1003
40 N=MAX	GRID 39	1004
WRITE(6,50) NGRID,N	GRID 40	1005
50 FORMAT(23H1BANDIT WARNING MESSAGE/10X,6H\$GRID ,I10,5X,	GRID 41	1006
+ 9HTOO LARGE /10X,6H\$GRID ,I10,5X,12H\$SUBSTITUTED.)	GRID 42	1007
GO TO 20	GRID 43	1008
END	GRID 44	1009
SUBROUTINE READIT(A,IP,NIP)	READIT 2	1010
C THIS ROUTINE READS AND STORES (IN IP) NUMERIC DATA APPEARING ON	READIT 3	1011
C \$-CONTROL CARDS UP TO COLUMN 72.	READIT 4	1012
DIMENSION ANUM(10)	READIT 5	1013
DIMENSION A(1),IP(1)	READIT 6	1014
DATA ANUM/1H0,1H1,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9/	READIT 7	1015
C INITIALIZE ARRAY.	READIT 8	1016
NIP=0	READIT 9	1017
DO 10 I=1,40	READIT10	1018
10 IP(I)=0	READIT11	1019
I=3	READIT12	1020
DO 70 KOUNT=1,40	READIT13	1021
NUM=0	READIT14	1022
NUMFL=0	READIT15	1023
20 I=I+1	READIT16	1024
IF(I.LE.72) GO TO 30	READIT17	1025
IF(NUMFL.EQ.1) GO TO 60	READIT18	1026
RETURN	READIT19	1027
30 K=99	READIT20	1028
DO 40 J=1,10	READIT21	1029
40 IF(A(I).EQ.ANUM(J)) K=J-1	READIT22	1030
IF(K.NE.99) GO TO 50	READIT23	1031
IF(NUMFL) 60,20,60	READIT24	1032
50 NUMFL=1	READIT25	1033
NUM=10*NUM+K	READIT26	1034
GO TO 20	READIT27	1035
60 NIP=KOUNT	READIT28	1036
IP(NIP)=NUM	READIT29	1037
70 CONTINUE	READIT30	1038
NIP=40	READIT31	1039
RETURN	READIT32	1040
END	READIT33	1041
SUBROUTINE BOMBIT(IERR)	BOMBIT 2	1042
C BOMB BANDIT TO SUPPRESS THE EXECUTION OF NASTRAN.	BOMBIT 3	1043
COMMON /B/ IPARAM(20)	BOMBIT 4	1044
COMMON /K/ II(7),KORE,IFL	BOMBIT 5	1045
3 FORMAT(43H1INSUFFICIENT CORE OR \$GRID N CARD REQUIRED)	JJ 21	1046
5 FORMAT(20H(1H+,130X//))	BOMBIT15	1047
CALL REMARK(40H *****)	BOMBIT16	1048
GO TO (10,20,30,40,50,60,70,80,90), IERR	BOMBIT17	1049
C EOF ENCOUNTERED.	BOMBIT18	1050
10 WRITE(6,12)	BOMBIT19	1051
12 FORMAT(55H1BANDIT FATAL ERROR - MISSING BEGIN BULK OR ENDDATA,	BOMBIT20	1052
+ 6H CARD.)	BOMBIT21	1053
CALL REMARK(39H **MISSING BEGIN BULK OR ENDDATA CARD)	BOMBIT22	1054
GO TO 500	BOMBIT23	1055
C BULK DATA CARD OUT OF SORT.	BOMBIT24	1056
20 CALL REMARK(31H **BULK DATA CARD OUT OF SORT)	BOMBIT25	1057
GO TO 500	BOMBIT26	1058
C SEQGP CARDS IN DECK AND RESEQUENCING REQUESTED.	BOMBIT27	1059
30 CALL REMARK(32H **SEQGP CARDS ALREADY IN DECK)	BOMBIT28	1060
GO TO 500	BOMBIT29	1061
C \$SCHEME ILLEGAL ARGUMENTS.	BOMBIT30	1062
40 WRITE(6,42)	BOMBIT31	1063
42 FORMAT(46H1BANDIT FATAL ERROR - ILLEGAL ARGUMENTS ON,	BOMBIT32	1064
+ 14H \$SCHEME CARD.)	BOMBIT33	1065
CALL REMARK(30H **ILLEGAL \$SCHEME ARGUMENTS)	BOMBIT34	1066
GO TO 500	BOMBIT35	1067
C TOO MANY TERMS IN MPC EQUATION.	BOMBIT36	1068
50 CALL REMARK(36H **MPC EQUATION HAS TOO MANY TERMS)	BOMBIT37	1069
GO TO 500	BOMBIT38	1070
C MAXDEG EXCEEDED.	BOMBIT39	1071
60 CALL REMARK(28H **MAXIMUM DEGREE EXCEEDED)	BOMBIT40	1072
WRITE(6,3)	JJ 22	1073
GO TO 500	BOMBIT42	1074
C MAXGRD EXCEEDED.	BOMBIT43	1075
70 CALL REMARK(39H **MAX NUMBER OF GRID POINTS EXCEEDED)	BOMBIT44	1076
WRITE(6,3)	JJ 23	1077
GO TO 500	BOMBIT46	1078
C NON-EXISTENT GRID POINT REFERENCE ON \$-CARD	BOMBIT47	1079
80 CALL REMARK(32H **ILLEGAL REFERENCE ON \$-CARD)	BOMBIT48	1080
GO TO 500	BOMBIT49	1081
C TOO MANY GRID POINTS ON \$-CARD.	BOMBIT50	1082
90 WRITE(6,92)	BOMBIT51	1083
92 FORMAT(51H1BANDIT FATAL ERROR - TOO MANY POINTS ON \$-CARD)	BOMBIT52	1084
CALL REMARK(30H **TOO MANY POINTS ON \$-CARD)	BOMBIT53	1085
GO TO 500	BOMBIT54	1086
C ABORT BANDIT.	BOMBIT55	1087
500 CALL REMARK(17H **BANDIT ABORT)	BOMBIT56	1088
CALL REMARK(23H **NASTRAN SUPPRESSED)	BOMBIT57	1089
CALL REMARK(40H *****)	BOMBIT58	1090
WRITE(6,5)	BOMBIT59	1091
STOP	BOMBIT66	1092
END	BOMBIT67	1093
SUBROUTINE SCAT(KG,NCON,NEW,INV,II3,NORIG)	SCAT 2	1094
C THIS ROUTINE USES SCATTER SORT TECHNIQUES FOR EACH GRID POINT	SCAT 3	1095
C ENCOUNTERED TO DETERMINE WHETHER OR NOT THE POINT HAS	SCAT 4	1096
C BEEN SEEN BEFORE. IF NOT, INV, NORIG, AND NEW ARE UPDATED.	SCAT 5	1097
C INV(I,1) CONTAINS AN ORIGINAL GRID POINT NUMBER	SCAT 6	1098
C INV(I,2) CONTAINS THE INTERNAL NUMBER ASSIGNED TO IT (BEFORE SORTING)	SCAT 7	1099
DIMENSION INV(II3,2),NORIG(1)	SCAT 8	1100

COMMON /A/ MAXGRD,MAXDEG,KMOD	SCAT 9	1101
DIMENSION KG(1)	SCAT 10	1102
DO 100 I=1,NCON	SCAT 11	1103
NOLD=KG(I)	SCAT 12	1104
IF(NOLD.EQ.0)GO TO 100	SCAT 13	1105
LOC=NOLD-1	SCAT 14	1106
10 LOC=MOD(LOC,KMOD)+1	SCAT 15	1107
20 IF(INV(LOC,1).NE.0) GO TO 30	SCAT 16	1108
INV(LOC,1)=NOLD	SCAT 17	1109
NEW=NEW+1	SCAT 18	1110
IF(NEW.GT.MAXGRD) GO TO 150	SCAT 19	1111
NORIG(NEW)=NOLD	SCAT 20	1112
INV(LOC,2)=NEW	SCAT 21	1113
GO TO 40	SCAT 22	1114
30 IF(INV(LOC,1).NE.NOLD) GO TO 10	SCAT 23	1115
40 KG(I)=INV(LOC,2)	SCAT 24	1116
100 CONTINUE	SCAT 25	1117
RETURN	SCAT 26	1118
150 WRITE(6,160) MAXGRD	SCAT 27	1119
160 FORMAT(35H1 THIS STRUCTURE CONTAINS MORE THAN,I6,	SCAT 28	1120
+ 14H GRID POINTS. /14H FATAL ERROR.)	SCAT 29	1121
CALL JOMBIT(7)	SCAT 30	1122
END	SCAT 31	1123
SUBROUTINE BRIGIT(IG,II1,INV,II3,INT,ICC,NORIG,IP)	BRIGIT 2	1124
C THIS ROUTINE GENERATES A NEW INTERNAL/EXTERNAL CORRESPONDENCE	BRIGIT 3	1125
C TABLE NORIG AND CONNECTION TABLE IG SUCH THAT THE NEW INTERNAL	BRIGIT 4	1126
C NUMBERS CORRESPOND TO A SORT OF THE ORIGINAL NUMBERS INTO	BRIGIT 5	1127
C ASCENDING ORDER.	BRIGIT 6	1128
C INPUT - IG,INV,NORIG	BRIGIT 7	1129
C OUTPUT - IG,NORIG,ICC	BRIGIT 8	1130
C SCRATCH - INT,IP	BRIGIT 9	1131
DIMENSION IG(II1,1),INV(II3,2)	BRIGIT10	1132
DIMENSION INT(1),ICC(1),NORIG(1),IP(1)	BRIGIT11	1133
COMMON /S/ NN,MM,IH,IJ	BRIGIT12	1134
COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC	BRIGIT13	1135
COMMON /BITS/ NBITIN,NBITEX,IPASS	BRIGIT14	1136
REWIND 8	BRIGIT15	1137
C PERFORM A ROUGH SORT OF THE ORIGINAL GRID NUMBERS.	BRIGIT16	1138
L=0	BRIGIT17	1139
KFAC=-1	BRIGIT18	1140
20 KFAC=KFAC+1	BRIGIT19	1141
MIN=2147483647	BRIGIT20	1142
DO 50 I=1,KMOD	BRIGIT21	1143
IF(INV(I,1).GT.(KFAC*KMOD))	BRIGIT22	1144
+ MIN=MIN(MIN,INV(I,1))	BRIGIT23	1145
50 CONTINUE	BRIGIT24	1146
KFAC=(MIN-1)/KMOD	BRIGIT25	1147
DO 80 I=1,KMOD	BRIGIT26	1148
IS=INV(I,1)	BRIGIT27	1149
IF(IS.LE.(KFAC*KMOD).OR.IS.GT.(KFAC+1)*KMOD)GO TO 80	BRIGIT28	1150
L=L+1	BRIGIT29	1151
INT(L)=INV(I,1)	BRIGIT30	1152
80 CONTINUE	BRIGIT31	1153
IF(L.LT.NN)GO TO 20	BRIGIT32	1154
C COMPLETE THE SORTING OF THE ORIGINAL GRID NUMBERS.	BRIGIT33	1155
CALL SORT(INT,NN).	BRIGIT34	1156
C DETERMINE CORRESPONDENCE (ICC) BETWEEN NORIG AND INT ARRAYS.	BRIGIT35	1157
DO 130 I=1,NN	BRIGIT36	1158
L=INT(I)	BRIGIT37	1159
LOC=L-1	BRIGIT38	1160
110 LOC=MOD(LOC,KMOD)+1	BRIGIT39	1161
120 IF(INV(LOC,1).NE.L) GO TO 110	BRIGIT40	1162
M=INV(LOC,2)	BRIGIT41	1163
ICC(M)=I	BRIGIT42	1164
130 CONTINUE	BRIGIT43	1165
C TRANSFER INT ARRAY TO NORIG ARRAY.	BRIGIT44	1166
DO 220 I=1,NN	BRIGIT45	1167
220 NORIG(I)=INT(I)	BRIGIT46	1168
C CHANGE IG MATRIX ACCORDING TO CORRESPONDENCE TABLE ICC.	BRIGIT47	1169
CALL SWITCH(IG,II1,INT,ICC,IP(1),IP(MAXDEG+1))	BRIGIT48	1170
REWIND 8	BRIGIT49	1171
RETURN	BRIGIT50	1172
END	BRIGIT51	1173
SUBROUTINE SORT(LIST,NL)	SORT 2	1174
C THIS SUBROUTINE SORTS A LIST OF LENGTH NL AND IS BIASED TOWARDS THOSE	SORT 3	1175
C LISTS NOT BADLY OUT OF SORT.	SORT 4	1176
DIMENSION LIST(1)	SORT 5	1177
IF(NL.LE.1) RETURN	SORT 6	1178
NL1=NL-1	SORT 7	1179
DO 20 I=1,NL1	SORT 8	1180
K=NL-I	SORT 9	1181
KFLAG=0	SORT 10	1182
DO 10 J=1,K	SORT 11	1183
IF(LIST(J).LE.LIST(J+1)) GO TO 10	SORT 12	1184
KFLAG=1	SORT 13	1185
L=LIST(J)	SORT 14	1186
LIST(J)=LIST(J+1)	SORT 15	1187
LIST(J+1)=L	SORT 16	1188
10 CONTINUE	SORT 17	1189
IF(KFLAG.EQ.0) RETURN	SORT 18	1190
20 CONTINUE	SORT 19	1191
RETURN	SORT 20	1192
END	SORT 21	1193
SUBROUTINE SETIG(KG1,KG2,IG,II1,NORIG)	SETIG 2	1194
C THIS ROUTINE SETS IG(KG1,-)=KG2 AND IG(KG2,-)=KG1 IF THIS	SETIG 3	1195
C CONNECTION HAS NOT ALREADY BEEN SET.	SETIG 4	1196
DIMENSION IG(II1,1),NORIG(1)	SETIG 5	1197
COMMON /S/ NN,MM,IH,IB	SETIG 6	1198
COMMON /A/ MAXGRD,MAXDEG,KMOD,NMPC	SETIG 7	1199
COMMON /BITS/ NBITIN,NBITEX,IPASS	SETIG 8	1200

```

      IF(KG1.EQ.0)RETURN
      IF(KG2.EQ.0)RETURN
      IF(KG1.EQ.KG2)RETURN
      DO 50 LOOP=1,2
      L=KG1
      K=KG2
      IF(LOOP.EQ.1) GO TO 20
      L=KG2
      K=KG1
20  M=0
30  M=M+1
      IF(M.GT.MAXDEG) GO TO 60
      IS = IG(L,M)
      IF(IS.EQ.0) GO TO 40
      IF(IS.NE.K) GO TO 30
      GO TO 50
40  IG(L,M) = K
      MM=MAX0(MM,M)
50  CONTINUE
      RETURN
60  WRITE(6,70) NJRIG(L),MAXDEG
70  FORMAT(12H1 GRID POINT,I12,26H  HAS DEGREE GREATER THAN,I6/
+ 14H  FATAL ERROR. )
      CALL BOMBIT(6)
      END
      SUBROUTINE TIGER(NEQ,IG,I11,LIST,NORIG)
C THIS ROUTINE MAKES ADJUSTIONS TO THE CONNECTION TABLE IG TO REFLECT
C THE PRESENCE OF MPC'S AND STORES THE DEPENDENT POINTS IN LIST.
C NEQ=NUMBER OF MPC EQUATIONS.
      DIMENSION IG(I11,1),LIST(1),NORIG(1)
      COMMON /S/ NN,MM,IH,IB
      COMMON /A/ MAXGR0,MAXDEG,KMOD,NMPC
      COMMON /BITS/ NBITIN,NBITEX,IPASS
      DIMENSION K(40)
      IF(NEQ.EQ.0)RETURN
      REWIND 11
C INITIALIZE LIST.
      DO 20 I=1,NN
20  LIST(I)=0
C GENERATE NEW CONNECTIONS.
      DO 100 II=1,NEQ
      READ(11)KJ
      IGRID=KG(1)
      LIST(IGRID)=IGRID
      DO 100 I=1,MAXDEG
      L = IG(IGRID,I)
      DO 100 J=2,NMPC
100  CALL SETIG(L,KG(J),IG,I11,NORIG)
      REWIND 11
      RETURN
      END
      SUBROUTINE SWITCH(IG,I11,IFLAG,KT,KA,KB)
C THIS SUBROUTINE GENERATES A NEW IG MATRIX ACCORDING TO THE
C CORRESPONDENCE TABLE KT, WHICH MUST BE SET UP
C PRIOR TO THE CALL. ONLY INTERNAL NUMBERS ARE ALLOWED
C AS VALUES OF KT.
C
C INPUT - IG,KT
C OUTPUT - IG
C SCRATCH - IFLAG,KA,KB
C
      DIMENSION IG(I11,1),IFLAG(1),KT(1),KA(1),KB(1)
      COMMON /S/ NN,MM,IH,IB
      COMMON /A/ MAXGR0,MAXDEG,KMOD,NMPC
      COMMON /BITS/ NBITIN,NBITEX,IPASS
C KT=CORRESPONDENCE TABLE. KT(IJD) = NEW.
C KA,KB = TEMPORARY STORAGE ROWS.
      DO 100 I=1,NN
      DO 90 J=1,MM
      L = IG(I,J)
      IF(L.LE.0) GO TO 100
      IS=KT(L)
      IG(I,J) = IS
90  CONTINUE
100  CONTINUE
C INITIALIZE IFLAG.
      DO 120 I=1,NN
120  IFLAG(I)=0
C INITIALIZE TEMPORARY STORAGE ROWS.
      DO 130 I=1,MM
      KA(I)=0
130  KB(I)=0
C RE-ORDER ROWS OF IG MATRIX.
      DO 200 IROW=1,NN
      IF(IFLAG(IROW).EQ.1) GO TO 200
      IF(KT(IROW).EQ.IROW) GO TO 200
      IFLAG(IROW)=1
      DO 140 J=1,MM
140  KB(J) = IG(IROW,J)
      L=KT(IROW)
      IFLAG(L)=1
      DO 160 J=1,MM
      KA(J) = IG(L,J)
      IG(L,J) = KB(J)
160  KB(J)=KA(J)
      M=KT(L)
      IF(IFLAG(M).EQ.1) GO TO 170
      L=M
      GO TO 150
170  DO 180 J=1,MM

```

```

      SETIG 9      1201
      SETIG 10     1202
      SETIG 11     1203
      SETIG 12     1204
      SETIG 13     1205
      SETIG 14     1206
      SETIG 15     1207
      SETIG 16     1208
      SETIG 17     1209
      SETIG 18     1210
      SETIG 19     1211
      SETIG 20     1212
      JJ 24        1213
      SETIG 22     1214
      SETIG 23     1215
      SETIG 24     1216
      JJ 25        1217
      SETIG 26     1218
      SETIG 27     1219
      SETIG 28     1220
      SETIG 29     1221
      SETIG 30     1222
      SETIG 31     1223
      SETIG 32     1224
      SETIG 33     1225
      TIGER 2      1226
      TIGER 3      1227
      TIGER 4      1228
      TIGER 5      1229
      TIGER 6      1230
      TIGER 7      1231
      TIGER 8      1232
      TIGER 9      1233
      TIGER 10     1234
      TIGER 11     1235
      TIGER 12     1236
      TIGER 13     1237
      TIGER 14     1238
      TIGER 15     1239
      TIGER 16     1240
      TIGER 17     1241
      TIGER 18     1242
      TIGER 19     1243
      TIGER 20     1244
      TIGER 21     1245
      JJ 26        1246
      TIGER 23     1247
      TIGER 24     1248
      TIGER 25     1249
      TIGER 26     1250
      TIGER 27     1251
      SWITCH 2     1252
      SWITCH 3     1253
      SWITCH 4     1254
      SWITCH 5     1255
      SWITCH 6     1256
      SWITCH 7     1257
      SWITCH 8     1258
      SWITCH 9     1259
      SWITCH10     1260
      SWITCH11     1261
      SWITCH12     1262
      SWITCH13     1263
      SWITCH14     1264
      SWITCH15     1265
      SWITCH16     1266
      SWITCH17     1267
      SWITCH18     1268
      SWITCH19     1269
      JJ 27        1270
      SWITCH21     1271
      SWITCH22     1272
      JJ 28        1273
      SWITCH24     1274
      SWITCH25     1275
      SWITCH26     1276
      SWITCH27     1277
      SWITCH28     1278
      SWITCH29     1279
      SWITCH30     1280
      SWITCH31     1281
      SWITCH32     1282
      SWITCH33     1283
      SWITCH34     1284
      SWITCH35     1285
      SWITCH36     1286
      SWITCH37     1287
      SWITCH38     1288
      JJ 29        1289
      SWITCH40     1290
      SWITCH41     1291
      SWITCH42     1292
      JJ 30        1293
      JJ 31        1294
      SWITCH45     1295
      SWITCH46     1296
      SWITCH47     1297
      SWITCH48     1298
      SWITCH49     1299
      SWITCH50     1300

```



```

100 IG(M,J) = KB(J)
200 CONTINUE
    RETURN
    END
SUBROUTINE MORRIS(LIST,NL,IG,I11)
C THIS ROUTINE DELETES ALL REFERENCE IN THE CONNECTION TABLE IG
C TO THOSE POINTS IN A LIST OF LENGTH NL.
    DIMENSION IG(I11,1),LIST(1)
    COMMON /S/ NM,MM
    COMMON /A/ MAXGRD
    COMMON /BITS/ NBITIN,NBITEX
C COMPRESS OUT DUPLICATE ENTRIES IN LIST.
    CALL FIXIT(LIST,NL)
    IF(NL.LE.0) RETURN
    MM1=MM-1
    DO 60 IJ=1,NL
    I=LIST(IJ)
    DO 50 J=1,MM
    L=IG(I,J)
    IF(L.EQ.0) GO TO 60
    K=0
20 K=K+1
    M=IG(L,K)
    IF(M.NE.I) GO TO 20
    IF(K.GE.MM) GO TO 40
    DO 30 N=K,MM1
    IS=IG(L,N+1)
30 IG(L,N) = IS
40 IG(L,MM) = 0
    IG(I,J) = 0
50 CONTINUE
60 CONTINUE
    RETURN
    END
SUBROUTINE FIXIT(LIST,NL)
C THIS ROUTINE COMPRESSES OUT ZEROES AND MULTIPLE ENTRIES IN A LIST
C ORIGINALLY OF LENGTH NL. A CORRECTED LENGTH NL IS RETURNED TO
C THE CALLING PROGRAM.
    DIMENSION LIST(1)
    IF(NL.LE.0) RETURN
    IF(NL.EQ.1) GO TO 110
    NL1=NL-1
C DELETE DUPLICATE ENTRIES.
    DO 20 I=1,NL1
    IF(LIST(I).EQ.0) GO TO 20
    I1=I+1
    DO 10 J=I1,NL
    IF(LIST(I).NE.LIST(J)) GO TO 10
    LIST(I)=0
    GO TO 20
10 CONTINUE
20 CONTINUE
C DELETE ZEROES.
    DO 40 I=1,NL1
    K=0
25 IF(LIST(I).NE.0) GO TO 40
    K=K+1
    DO 30 J=I,NL1
    LIST(J)=LIST(J+1)
30 LIST(NL)=0
    IF(K.GE.(NL-I+1)) GO TO 70
    GO TO 25
40 CONTINUE
C CALCULATE NEW LENGTH NL.
70 DO 80 I=1,NL
    J=NL-I+1
    IF(LIST(J).NE.0) GO TO 90
80 CONTINUE
90 NL=NL-I+1
    RETURN
110 IF(LIST(1).EQ.0) NL=0
    RETURN
    END
SUBROUTINE SCHEME(NT,NUM,NOM,IO,IP,IG,I11,IC,IDEG,IOIS,IM,
+ NEW,ICC,ILD,IPP)
C IO IS VALID IFF 2.LE.IO.LE.3
    DIMENSION IG(I11,1),IC(1),IDEG(1),IOIS(1),IM(1)
    DIMENSION NEW(1),ICC(1),ILD(1),IPP(1)
C IPP HAS DIMENSION 2*MAXDEG
    COMMON /S/ NM,MM,IM,I0
    COMMON /P/ IM0,IDE
    COMMON /A/ MAXGRD
    COMMON /C/ INAKN,LINE,KORIG,KNEH
    COMMON /BITS/ NBITIN,NBITEX,IPASS
    COMMON /TIME/ STIME,NCH
    COMMON /J/ IPARAM(20)
    COMMON /JOL/ ISTART(100),IGNORE(100),IFIRST(100)
    COMMON /JOLL/ IDIM,ISTA,IIG,IFIR
    DIMENSION NODESL(100)
    EQUIVALENCE (IM,ATIME)
C DETERMINE THE DEGREE OF EACH NODE.
    CALL DEGREE(IG,I11,IDEG)
C DETERMINE MUJO, THE MOST PREVALENT NODAL DEGREE.
    MUJO=MODE(IDEG,IPP)
C DETERMINE THE NUMBER OF COMPONENTS, NCH.
    NCH=COMPNT(IG,I11,IC,IDEG,IM,ICC)
C DETERMINE THE MAXIMUM DEGREE OF ANY NODE.
    MAXD=MAXDGR(0,IC,IDEG)
    MM=MAXD
C DETERMINE THE ORIGINAL BANDWIDTH, IS.

```

JJ	32	1301
SWITCH52		1302
SWITCH53		1303
SWITCH54		1304
MORRIS 2		1305
MORRIS 3		1306
MORRIS 4		1307
MORRIS 5		1308
MORRIS 6		1309
MORRIS 7		1310
MORRIS 8		1311
MORRIS 9		1312
MORRIS10		1313
MORRIS11		1314
MORRIS12		1315
MORRIS13		1316
MORRIS14		1317
MORRIS15		1318
JJ	33	1319
MORRIS17		1320
MORRIS18		1321
MORRIS19		1322
JJ	34	1323
MORRIS21		1324
MORRIS22		1325
MORRIS23		1326
JJ	35	1327
JJ	36	1328
JJ	37	1329
JJ	38	1330
MORRIS28		1331
MORRIS29		1332
MORRIS30		1333
MORRIS31		1334
FIXIT 2		1335
FIXIT 3		1336
FIXIT 4		1337
FIXIT 5		1338
FIXIT 6		1339
FIXIT 7		1340
FIXIT 8		1341
FIXIT 9		1342
FIXIT 10		1343
FIXIT 11		1344
FIXIT 12		1345
FIXIT 13		1346
FIXIT 14		1347
FIXIT 15		1348
FIXIT 16		1349
FIXIT 17		1350
FIXIT 18		1351
FIXIT 19		1352
FIXIT 20		1353
FIXIT 21		1354
FIXIT 22		1355
FIXIT 23		1356
FIXIT 24		1357
FIXIT 25		1358
FIXIT 26		1359
FIXIT 27		1360
FIXIT 28		1361
FIXIT 29		1362
FIXIT 30		1363
FIXIT 31		1364
FIXIT 32		1365
FIXIT 33		1366
FIXIT 34		1367
FIXIT 35		1368
FIXIT 36		1369
FIXIT 37		1370
FIXIT 38		1371
FIXIT 39		1372
FIXIT 40		1373
SCHEME 2		1374
SCHEME 3		1375
SCHEME 4		1376
SCHEME 5		1377
SCHEME 6		1378
SCHEME 7		1379
SCHEME 8		1380
SCHEME 9		1381
SCHEME10		1382
SCHEME11		1383
SCHEME12		1384
SCHEME13		1385
SCHEME14		1386
SCHEME15		1387
SCHEME16		1388
SCHEME17		1389
SCHEME18		1390
SCHEME19		1391
SCHEME20		1392
SCHEME21		1393
SCHEME22		1394
SCHEME23		1395
SCHEME24		1396
SCHEME25		1397
SCHEME26		1398
SCHEME27		1399
SCHEME28		1400

DO 30 I=1,NN	SCHEME29	1401
NEW(I)=I	SCHEME30	1402
30 ILD(I)=I	SCHEME31	1403
IS=MAXBND(0,IG,II1,IC,IOEG,NEW,ILD)	SCHEME32	1404
KORIG=IS	SCHEME33	1405
IM0=IM	SCHEME34	1406
C INITIALIZE NEW AND ILD ARRAYS.	SCHEME35	1407
DO 35 I=1,NN	SCHEME36	1408
NEW(I)=0	SCHEME37	1409
35 ILD(I)=0	SCHEME38	1410
C IF IP IS NOT EQUAL TO 0, THEN PRINT COMPONENT NUMBER,DEGREE,	SCHEME39	1411
C AND CONNECTIONS FOR EACH NODE.	SCHEME40	1412
IF(IP.EQ.0) GO TO 31	SCHEME41	1413
C PRINT INTERNAL NUMBER CONNECTION TABLE.	SCHEME42	1414
DO 60 I=1,NN	SCHEME43	1415
IF(MOD(I,LINE).EQ.1)WRITE(6,19)	SCHEME44	1416
19 FORMAT(37H1 LABEL COMP MUIST DEGR CONNECTIONS ,10X,	SCHEME45	1417
1 18H(INTERNAL NUMBER3))	SCHEME46	1418
MDIST=0	SCHEME47	1419
DO 65 J=1,MAXD	SCHEME48	1420
IS1 = IG(I,J)	JJ 39	1421
IF(IS1.EQ.0)GO TO 65	SCHEME50	1422
MDIST=MAX0(MDIST,IABS(I-IS1))	SCHEME51	1423
65 CONTINUE	SCHEME52	1424
IPP(1)=IC(I)	SCHEME53	1425
IPP(2)=IOEG(I)	SCHEME54	1426
DO 61J IPI=1,MAXD	SCHEME55	1427
610 IPP (IPI+2) = IG(I,IPI)	JJ 40	1428
IS1=MAXD+2	SCHEME57	1429
60 WRITE(6,61) I,IPP(1),MDIST,(IPP(J),J=2,IS1)	SCHEME58	1430
61 FORMAT(5I6,20I5/ 25(25X,21I5/))	SCHEME59	1431
WRITE(6,700)	SCHEME60	1432
700 FORMAT(1H1,/,32X,31HPROGRAMMER INFORMATION MESSAGES /)	SCHEME61	1433
WRITE(6,29) IS,IM	SCHEME62	1434
29 FORMAT(19H ORIGINAL BANDWIDTH,I7,10H PROFILE,I10)	SCHEME63	1435
WRITE(6,27) MODD	SCHEME64	1436
27 FORMAT(30H MODE OF DEGREE DISTRIBUTION =,I5)	SCHEME65	1437
IF(ISTA.LE.0) GO TO 31	SCHEME66	1438
WRITE(6,701)	SCHEME67	1439
701 FORMAT(34H STARTING NOOES SUPPLIED BY USER -)	SCHEME68	1440
WRITE(6,100) (ISTART(I),I=1,ISTA)	SCHEME69	1441
31 CONTINUE	JJ 41	1442
IF(IO.EQ.3) IS=IM	SCHEME72	1443
C GENERATE NUMBERING SCHEME FOR EACH COMPONENT, NC.	SCHEME73	1444
DO 500 NC=1,NCM	SCHEME74	1445
C DETERMINE THE RANGE OF DEGREES (MI TO MAD) OF NODES OF INTEREST.	SCHEME75	1446
MI=MINDEG(NC,IG,IOEG)	SCHEME76	1447
MAD=MI	SCHEME77	1448
IF(NOM) 90,87,90	SCHEME78	1449
90 MA=MAXDGR(NC,IC,IOEG)	SCHEME79	1450
MAD=MI+((MA-MI)*NUM)/NOM	SCHEME80	1451
C MAKE SURE THAT MAD IS LESS THAN MODD.	SCHEME81	1452
MAD=MIN0(MAD,MODD-1)	SCHEME82	1453
MAD=MAX0(MAD,MI)	SCHEME83	1454
C DETERMINE BANDWIDTH OR SUM CRITERION FOR EACH NODE MEETING SPECI-	SCHEME84	1455
C FIED CONDITION.	SCHEME85	1456
87 IF(IP.EQ.0) GO TO 91	SCHEME86	1457
WRITE(6,162) NC	SCHEME87	1458
162 FORMAT(22H ***** COMPONENT,I5,12H *****)	SCHEME88	1459
IF(IO.EQ.2) WRITE(6,169)	SCHEME89	1460
169 FORMAT(43H OPTION 2 SELECTED (CRITERION - BANDWIDTH ,	SCHEME90	1461
+ 57HMINIMIZATION; CONDITION - MINMAX NUMBER OF NODES/LEVEL)	SCHEME91	1462
IF(IO.EQ.3) WRITE(6,179)	SCHEME92	1463
179 FORMAT(52H OPTION 3 SELECTED (CRITERION - MINIMIZATION OF SUM; ,	SCHEME93	1464
+ 44H CONDITION - MINMAX NUMBER OF NODES/LEVEL)	SCHEME94	1465
91 CALL UJAM(NC,MAD,NL,NODESL,MAXLEV,IG,II1,IC,IOEG,IDIS,IM,ICC)	SCHEME95	1466
IF(IP.EQ.0) GO TO 67	SCHEME96	1467
WRITE(6,39) NC,MAD	SCHEME97	1468
WRITE(6,59) MAXLEV	SCHEME98	1469
WRITE(6,100) (NODESL(J),J=1,NL)	SCHEME99	1470
67 CONTINUE	SCHEM100	1471
IF(ISTA.LE.0) GO TO 760	SCHEM101	1472
M=0	SCHEM102	1473
DO 750 I=1,ISTA	SCHEM103	1474
J=ISTART(I)	SCHEM104	1475
IF(IC(J).NE.NC) GO TO 750	SCHEM105	1476
M=M+1	SCHEM106	1477
DO 755 K=1,99	SCHEM107	1478
L=101-K	SCHEM108	1479
755 NODESL(L)=NODESL(L-1)	SCHEM109	1480
NODESL(1)=J	SCHEM110	1481
750 CONTINUE	SCHEM111	1482
NL=MIN0(NL+M,100)	SCHEM112	1483
CALL FIXIT(NODESL,NL)	SCHEM113	1484
760 CONTINUE	SCHEM114	1485
IF(IP.EQ.0) GO TO 63	SCHEM115	1486
IF(ISTA.LE.0) GO TO 63	SCHEM116	1487
WRITE(6,730)	SCHEM117	1488
730 FORMAT(48H MERGED LIST OF STARTING NODES SUPPLIED BY USER ,	SCHEM118	1489
+ 15HAND BY BANDIT -)	SCHEM119	1490
WRITE(6,100) (NODESL(I),I=1,NL)	SCHEM120	1491
39 FORMAT(10H COMPONENT,I5,19H MAX DEGREE USED,I5)	SCHEM121	1492
59 FORMAT(52H STARTING NODES FOR MINMAX NUMBER OF NODES PER LEVEL,I5)	SCHEM122	1493
100 FORMAT(4X,20I5)	SCHEM123	1494
63 CONTINUE	SCHEM124	1495
JMAX=MIN0(NT,NL)	SCHEM125	1496
IM=900000000	SCHEM126	1497
IMM=IM	SCHEM127	1498
DO 400 J=1,JMAX	SCHEM128	1499
CALL RELABL(1,NODESL(J),IG,II1,IC,IOEG,IDIS,IM,NEW,ICC,ILD)	SCHEM129	1500

IB=MAXBND(IG,II1,IC,IDEG,NEW,ILD)	SCHEM130	1501
IF(IP.NE.0) WRITE(6,63) NODESL(J),IB,IM	SCHEM131	1502
69 FORMAT(14H STARTING NODE,I6,4X,9H BANDWIDTH,I6,3X,7H PROFILE,I6)	SCHEM132	1503
IF(IG.EQ.3) IB=IM	SCHEM133	1504
IE=ICC(NC+1)-1	SCHEM134	1505
IF(IM-IB) 400,350,300	SCHEM135	1506
300 IM=IB	SCHEM136	1507
IMM=IM	SCHEM137	1508
IJ=J	SCHEM138	1509
GO TO 400	SCHEM139	1510
350 IF(IMM.LE.IM) GO TO 400	SCHEM140	1511
IMM=IM	SCHEM141	1512
IJ=J	SCHEM142	1513
400 CONTINUE	SCHEM143	1514
CALL RELABL(1,NODESL(IJ),IG,II1,IC,IDEG,DIS,IM,NEW,ICC,ILD)	SCHEM144	1515
500 CONTINUE	SCHEM145	1516
CALL STACK(IDEG,NEW,ILD,IM)	SCHEM146	1517
IB=MAXBND(IG,II1,IC,IDEG,NEW,ILD)	SCHEM147	1518
IF(IP.EQ.0) GO TO 710	SCHEM148	1519
WRITE(6,705)	SCHEM149	1520
705 FORMAT(21H ORIGINAL LABELING -)	SCHEM150	1521
WRITE(6,708) KORIG,IM0	SCHEM151	1522
WRITE(6,707)	SCHEM152	1523
707 FORMAT(21H STD CM RELABELING -)	SCHEM153	1524
WRITE(6,708) IB,IM	SCHEM154	1525
708 FORMAT(14H,26X,9H BANDWIDTH,I7,10X,7H PROFILE,I10)	SCHEM155	1526
709 FORMAT(21H REV CM RELABELING -)	SCHEM156	1527
710 IF(IG.EQ.3) IB=IM	SCHEM157	1528
C PROFILE = SUM CRIT	SCHEM158	1529
C IS=ORIGINAL BANDWIDTH (OR SUM CRIT IF IG.EQ.3)	SCHEM159	1530
C IB=CURRENT BANDWIDTH (OR SUM CRIT IF IG.EQ.3)	SCHEM160	1531
C IM=CURRENT PROFILE, IM0=ORIGINAL PROFILE	SCHEM161	1532
IF(IB-IS) 715,742,744	SCHEM162	1533
742 IF(IM.LT.IM0) GO TO 715	SCHEM163	1534
744 DO 712 I=1,NN	SCHEM164	1535
ILD(I)=I	SCHEM165	1536
712 NEW(I)=I	SCHEM166	1537
CALL STACK(IDEG,NEW,ILD,IM)	SCHEM167	1538
IB=IS	SCHEM168	1539
IM=IM0	SCHEM169	1540
IF(IP.EQ.0) GO TO 715	SCHEM170	1541
WRITE(6,713)	SCHEM171	1542
713 FORMAT(21H ORIG CM RELABELING -)	SCHEM172	1543
WRITE(6,708) IB,IM	SCHEM173	1544
715 IME=IM	SCHEM174	1545
CALL REVERS(NEW,ILD)	SCHEM175	1546
IB=MAXBND(IG,II1,IC,IDEG,NEW,ILD)	SCHEM176	1547
IF(IP.EQ.0) GO TO 717	SCHEM177	1548
WRITE(6,709)	SCHEM178	1549
WRITE(6,708) IB,IM	SCHEM179	1550
717 IF(IM.LT.IME) GO TO 720	SCHEM180	1551
CALL REVERS(NEW,ILD)	SCHEM181	1552
IB=MAXBND(IG,II1,IC,IDEG,NEW,ILD)	SCHEM182	1553
720 IME=IM	SCHEM183	1554
KNEW=IB	SCHEM184	1555
IF(IP.EQ.0) GO TO 508	SCHEM185	1556
WRITE(6,722)	SCHEM186	1557
722 FORMAT(21H ** FINAL LABELING -)	SCHEM187	1558
WRITE(6,708) KNEW,IME	SCHEM188	1559
503 CONTINUE	JJ	42
600 RETURN	SCHEM194	1561
END	SCHEM195	1562
SUBROUTINE STACK(IDEG,NEW,ILD,IM)	STACK 2	1563
C STACK POINTS OF ZERO DEGREE AT END OF THE NUMBERING.	STACK 3	1564
DIMENSION IDEG(1),NEW(1),ILD(1),IM(1)	STACK 4	1565
C IM IS SCRATCH STORAGE.	STACK 5	1566
COMMON /S/ NN	STACK 6	1567
COMMON /ZERO/ KT	STACK 7	1568
KT=0	STACK 8	1569
NN1=NN-1	STACK 9	1570
C LIST POINTS OF ZERO DEGREE AND INCREMENT COUNTER KT.	STACK 10	1571
DO 10 I=1,NN	STACK 11	1572
IF(IDEG(I).GT.0) GO TO 10	STACK 12	1573
KT=KT+1	STACK 13	1574
IM(KT)=ILD(I)	STACK 14	1575
10 CONTINUE	STACK 15	1576
IF(KT.LE.0) GO TO 70	STACK 16	1577
C SORT LIST OF RENUMBERED NUMBERS TO BE STACKED.	STACK 17	1578
CALL SORT(IM,KT)	STACK 18	1579
C STACK POINTS OF ZERO DEGREE AT END OF NEW.	STACK 19	1580
DO 40 L=1,KT	STACK 20	1581
I=IW(L)-L+1	STACK 21	1582
K=NEW(I)	STACK 22	1583
IF(I.GE.NN) GO TO 30	STACK 23	1584
DO 20 J=I,NN1	STACK 24	1585
20 NEW(J)=NEW(J+1)	STACK 25	1586
30 NEW(NN)=K	STACK 26	1587
40 CONTINUE	STACK 27	1588
C CORRECT ILD, THE INVERSE OF NEW.	STACK 28	1589
70 DO 80 I=1,NN	STACK 29	1590
K=NEW(I)	STACK 30	1591
80 ILD(K)=I	STACK 31	1592
RETURN	STACK 32	1593
END	STACK 33	1594
SUBROUTINE REVERS(NEW,ILD)	REVERS 2	1595
C REVERSE THE NUMBERING OF THE FIRST NN-KT GRID POINTS.	REVERS 3	1596
C NN=NUMBER OF GRID POINTS.	REVERS 4	1597
C KT=THE NUMBER OF POINTS OF ZERO DEGREE (STACKED AT END OF NEW	REVERS 5	1598
BY STACK)	REVERS 6	1599
C	REVERS 7	1600
DIMENSION NEW(1),ILD(1)		

```

COMMON /S/ NN
COMMON /ZERO/ KT
C REVERSE NEW ARRAY.
  J=(NN-KT)/2
  LL=NN-KT+1
  DO 10 I=1,J
    L=LL-I
    K=NEW(L)
    NEW(L)=NEW(I)
  10 NEW(I)=K
C CORRECT ILO, THE INVERSE OF NEW.
  DO 20 J=1,NN
    K=NEW(I)
  20 ILO(K)=I
  RETURN
  END
SUBROUTINE DEGREE(IG,III,IOEG)
C SET UP THE IOEG ARRAY CONTAINING THE DEGREE OF EACH NODE STORED
C IN THE IG ARRAY.
C IOEG(I)=DEGREE OF NODE I
  DIMENSION IO(III,1),IOEG(1)
  COMMON /S/ NN,MM,IM,IS
  COMMON /A/ MAXGRD
  COMMON /BITS/ NBITIN,NBITEX,IPASS
  DO 100 I=1,NN
    IOEG(I)=0
  100 J=1,MM
    IF(IG(I,J)) 100,100,50
  50 IOEG(I)=IOEG(I)+1
  80 CONTINUE
  100 CONTINUE
  RETURN
  END
FUNCTION MODE(IOEG,MOJJ)
C COMPUTE MODE, THE MOST PREVALENT MODAL DEGREE. IF SEVERAL DEGREES
C ARE EQUALLY PREVALENT, THE LOWEST IS CHOSEN.
  COMMON /S/ NN,MM
  DIMENSION IOEG(1),MOJJ(1)
C IOEG(I)=DEGREE OF NODE I
C MOJJ(I)=NUMBER OF NODES OF DEGREE I
  DO 10 I=1,NN
    MOJJ(I)=0
  10 J=1,MM
    K=IOEG(I)
  20 MOJJ(K)=MOJJ(K)+1
  MODE=0
  MAX=0
  DO 30 I=1,MM
    K=MOJJ(I)
    IF(K,LL,MAX) GO TO 30
    MAX=K
  30 CONTINUE
  RETURN
  END
FUNCTION COMPNT(IG,III,IC,IOEG,IW,ICC)
C THIS FUNCTION HAS AS ITS VALUE THE NUMBER OF COMPONENTS STORED
C IN THE CONNECTION ARRAY IG.
C ALSO, IC AND ICC ARE SET UP.
C IC(I)=COMPONENT INDEX FOR NODE I
C ICC(I)=THE STARTING POSITION TO BE USED FOR LABELS IN COMPONENT I
C THUS, ICC(I+1)-ICC(I)=THE NUMBER OF NODES IN COMPONENT I
  DIMENSION IO(III,1),IC(1),IOEG(1),IW(1),ICC(1)
  COMMON /S/ NN,MM,IM,IS
  COMMON /A/ MAXGRD
  COMMON /BITS/ NBITIN,NBITEX,IPASS
C INITIALIZE ARRAYS.
  DO 100 I=1,NN
    ICC(I)=0
  100 IC(I)=0
  100 CONTINUE
  NC=0
  ICC(1)=1
C CHECK IF IC IS COMPLETE.
  100 DO 110 I=1,NN
    IF(IC(I)) 110,120,110
  110 COMPNT=NC
  RETURN
  120 NC=NC+1
  KI=0
  KO=1
  IW(1)=1
  IC(I)=NC
  IF(NC-1) 130,125,125
  125 IS=ICC(NC)+1
  ICC(NC+1)=IS
  130 KI=KI+1
  II=IW(KI)
  N=IOEG(II)
  IF(N) 140,105,140
  140 DO 200 I=1,N
    IA=IG(II,I)
    IF(IC(IA)) 200,150,200
  150 IC(IA)=NC
  KU=KO+1
  IW(KU)=IA
  IS=ICC(NC+1)+1
  ICC(NC+1)=IS
  200 CONTINUE
  IF(KO-KI) 105,105,140

```

```

REVERS 8      1601
REVERS 9      1602
REVERS10     1603
REVERS11     1604
REVERS12     1605
REVERS13     1606
REVERS14     1607
REVERS15     1608
REVERS16     1609
REVERS17     1610
REVERS18     1611
REVERS19     1612
REVERS20     1613
REVERS21     1614
REVERS22     1615
REVERS23     1616
DEGREE 2      1617
DEGREE 3      1618
DEGREE 4      1619
DEGREE 5      1620
DEGREE 6      1621
DEGREE 7      1622
DEGREE 8      1623
DEGREE 9      1624
DEGREE10     1625
DEGREE11     1626
DEGREE12     1627
JJ           1628
DEGREE14     1629
DEGREE15     1630
DEGREE16     1631
DEGREE17     1632
DEGREE18     1633
MODE 2        1634
MODE 3        1635
MODE 4        1636
MODE 5        1637
MODE 6        1638
MODE 7        1639
MODE 8        1640
MODE 9        1641
MODE 10       1642
MODE 11       1643
MODE 12       1644
MODE 13       1645
MODE 14       1646
MODE 15       1647
MODE 16       1648
MODE 17       1649
MODE 18       1650
MODE 19       1651
MODE 20       1652
MODE 21       1653
MODE 22       1654
MODE 23       1655
COMPNT 2      1656
COMPNT 3      1657
COMPNT 4      1658
COMPNT 5      1659
COMPNT 6      1660
COMPNT 7      1661
COMPNT 8      1662
COMPNT 9      1663
COMPNT10     1664
COMPNT11     1665
COMPNT12     1666
COMPNT13     1667
COMPNT14     1668
COMPNT15     1669
COMPNT16     1670
COMPNT17     1671
COMPNT18     1672
COMPNT19     1673
COMPNT20     1674
COMPNT21     1675
COMPNT22     1676
COMPNT23     1677
COMPNT24     1678
COMPNT25     1679
COMPNT26     1680
COMPNT27     1681
COMPNT28     1682
COMPNT29     1683
COMPNT30     1684
COMPNT31     1685
COMPNT32     1686
COMPNT33     1687
COMPNT34     1688
COMPNT35     1689
COMPNT36     1690
COMPNT37     1691
JJ           1692
COMPNT39     1693
COMPNT40     1694
COMPNT41     1695
COMPNT42     1696
COMPNT43     1697
COMPNT44     1698
COMPNT45     1699
COMPNT46     1700

```

```

      END
      FUNCTION MAXDGR(NC,IC,IDEG)
C THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DEGREE OF ANY NODE OF
C COMPONENT NC IF NC.GT.0
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.
      DIMENSION IC(1),IDEG(1)
      COMMON /S/ NN,MM,II,IB
      M=0
      DO 100 I=1,NN
        IF(NC)40,50,40
        IF(IC(I)-NC) 100,50,100
40      IF(IDEG(I)-M) 100,100,60
60      M=IDEG(I)
100    CONTINUE
      MAXDGR=M
      RETURN
      END
      FUNCTION MAXBND(NC,IG,II,IC,IDEG,NEW,ILO)
C THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DIFFERENCE BETWEEN NODE
C LABELS OF CONNECTED NODES FOR NODES OF COMPONENT NC.GT.0
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.
C THE NODAL RENUMBERING DEFINED BY ILO AND NEW MUST BE SET UP PRIOR
C TO THE FUNCTION CALL.
C COMPUTE IH, THE SUM CRIT (PROFILE).
      DIMENSION IG(II,1),IC(1),IDEG(1),NEW(1),ILO(1)
      COMMON /S/ NN,MM,II,IB
      COMMON /A/ MAXGRD
      COMMON /BITS/ NBITIN,NBITEX,IPASS
      IH=0
      M=0
      DO 100 I=1,NN
        MX=0
        IA=NEW(I)
        IF(NC)40,50,40
        IF(IA.LQ.0)GO TO 100
        IF(NC-IC(IA)) 100,50,100
        N=IDEG(IA)
        IF(N)100,100,150
        DO 90 J=1,N
          II = IG(IA,J)
          IB=MAX(0,I-ILO(II))
          IF(IB.GT.MX) MX=IB
90      CONTINUE
          IF(MX.GT.M) M=MX
          IH=IH+MX
100    CONTINUE
      MAXBND=M
      RETURN
      END
      FUNCTION MINDEG(NC,IC,IDEG)
C THIS FUNCTION HAS AS ITS VALUE THE MINIMUM DEGREE OF ANY NODE OF
C COMPONENT NC IF NC.GT.0
C IF NC.LE.0, ALL COMPONENTS ARE CONSIDERED.
      DIMENSION IC(1),IDEG(1)
      COMMON /S/ NN,MM,II,IB
      M=10000
      DO 100 I=1,NN
        IF(NC)40,50,40
        IF(IC(I)-NC) 100,50,100
40      IF(M-IDEG(I)) 100,100,60
60      M=IDEG(I)
100    CONTINUE
      MINDEG=M
      RETURN
      END
      SUBROUTINE DIAM(NC,MAXDEG,NL,NODESL,MAXLEV,
+ IG,II,IC,IDEG,IUIS,IIW,ICC)
C DETERMINE NL STARTING POINTS AND STORE IN NODESL.
      DIMENSION IG(II,1),IUIS(1),IIW(1),ICC(1),IC(1),IDEG(1)
      COMMON /S/ NN,MM,II,IB
      COMMON /A/ MAXGRD
      COMMON /BITS/ NBITIN,NBITEX,IPASS
      DIMENSION NODESL(1)
      NL=0
      MAXLEV=10000
      DO 100 I=1,NN
        IF(NC-IC(I)) 100,40,100
        IF(MAXDEG-IDEG(I)) 100,105,105
40      MD=IDIST(I,ML,MAXLEV,IG,II,IC,IDEG,IUIS,IIW,ICC)
105      MD=IDIST(I,ML,MAXLEV,IG,II,IC,IDEG,IUIS,IIW,ICC)
        IF(MD) 110,115,56
56      IF(ML-MAXLEV)58,64,100
58      MAXLEV=ML
        NL=1
        NODESL(1)=I
        GO TO 100
64      IF(NL.GE.100) GO TO 100
        NL=NL+1
        NODESL(NL)=I
100    CONTINUE
110    RETURN
115    ML=1
        NODESL(1)=I
        MAXLEV=0
        RETURN
      END
      SUBROUTINE RELABL(NS,NODES,IG,II,IC,IDEG,IUIS,IIW,NEW,ICC,ILO)
C GENERATE A RELABELING SCHEME STARTING WITH NS NODES FOR WHICH
C LABELS HAVE BEEN STORED IN ARRAY NODES.
C SET UP ILO AND NEW.
      ILO(ILO)=NEW

```

COMPNT47	1701
MAXDGR 2	1702
MAXDGR 3	1703
MAXDGR 4	1704
MAXDGR 5	1705
MAXDGR 6	1706
MAXDGR 7	1707
MAXDGR 8	1708
MAXDGR 9	1709
MAXDGR10	1710
MAXDGR11	1711
MAXDGR12	1712
MAXDGR13	1713
MAXDGR14	1714
MAXDGR15	1715
MAXDGR16	1716
MAXDGR17	1717
MAXBND 2	1718
MAXBND 3	1719
MAXBND 4	1720
MAXBND 5	1721
MAXBND 6	1722
MAXBND 7	1723
MAXBND 8	1724
MAXBND 9	1725
MAXBND10	1726
MAXBND11	1727
MAXBND12	1728
MAXBND13	1729
MAXBND14	1730
MAXBND15	1731
MAXBND16	1732
MAXBND17	1733
MAXBND18	1734
MAXBND19	1735
MAXBND20	1736
MAXBND21	1737
MAXBND22	1738
MAXBND23	1739
JJ 45	1740
MAXBND25	1741
MAXBND26	1742
MAXBND27	1743
MAXBND28	1744
MAXBND29	1745
MAXBND30	1746
MAXBND31	1747
MAXBND32	1748
MAXBND33	1749
MINDEG 2	1750
MINDEG 3	1751
MINDEG 4	1752
MINDEG 5	1753
MINDEG 6	1754
MINDEG 7	1755
MINDEG 8	1756
MINDEG 9	1757
MINDEG10	1758
MINDEG11	1759
MINDEG12	1760
MINDEG13	1761
MINDEG14	1762
MINDEG15	1763
MINDEG16	1764
MINDEG17	1765
DIAM 2	1766
DIAM 3	1767
DIAM 4	1768
DIAM 5	1769
DIAM 6	1770
DIAM 7	1771
DIAM 8	1772
DIAM 9	1773
DIAM 10	1774
DIAM 11	1775
DIAM 12	1776
DIAM 13	1777
DIAM 14	1778
DIAM 15	1779
DIAM 16	1780
DIAM 17	1781
DIAM 18	1782
DIAM 19	1783
DIAM 20	1784
DIAM 21	1785
DIAM 22	1786
DIAM 23	1787
DIAM 24	1788
DIAM 25	1789
DIAM 26	1790
DIAM 27	1791
DIAM 28	1792
DIAM 29	1793
DIAM 30	1794
DIAM 31	1795
RELABL 2	1796
RELABL 3	1797
RELABL 4	1798
RELABL 5	1799
RELABL 6	1800

C	NEW(NEW)=OLD, THE INVERSE OF ILD	RELABL 7	1801
	DIMENSION IG(II1,1),IC(1),IDEG(1),IDIS(1),IW(1),NEW(1),ICC(1)	RELABL 8	1802
	DIMENSION ILD(1)	RELABL 9	1803
	COMMON /S/ NN,MM,IH,IB	RELABL10	1804
	INTEGER X	RELABL11	1805
	COMMON /A/ MAXGRD	RELABL12	1806
	COMMON /BITS/ NBITIN,NBITEX,IPASS	RELABL13	1807
	DIMENSION NOUES(1),IAJ(50)	RELABL14	1808
	I=NOUES(1)	RELABL15	1809
	ICN=IC(I)	RELABL16	1810
	NT=ICC(ICN)-1	RELABL17	1811
	DO 50 I=1,NN	RELABL18	1812
	IF(IC(I)-ICN) 50,40,50	RELABL19	1813
40	IDIS(I)=0	RELABL20	1814
50	CONTINUE	RELABL21	1815
	DO 100 J=1,NS	RELABL22	1816
	JJ=NOUES(J)	RELABL23	1817
	IDIS(JJ)=-1	RELABL24	1818
	JT=J+NT	RELABL25	1819
	NEW(JT)=JJ	RELABL26	1820
100	ILU(JJ)=JT	RELABL27	1821
	KI=NT	RELABL28	1822
	KO=NS+NT	RELABL29	1823
	LL=KO	RELABL30	1824
	L=1	RELABL31	1825
	J=KO	RELABL32	1826
	NNC=ICC(ICN+1)-1	RELABL33	1827
130	KI=KI+1	RELABL34	1828
	IF(KI-LL)135,132,135	RELABL35	1829
132	L=L+1	RELABL36	1830
	LL=KO+1	RELABL37	1831
135	II=NEW(KI)	RELABL38	1832
	N=IDEG(II)	RELABL39	1833
	IF(N)140,255,140	RELABL40	1834
140	IJ=0	RELABL41	1835
	DO 200 I=1,N	RELABL42	1836
	IA = IL(II,I)	JJ 46	1837
	IF(IDIS(IA)) 200,150,200	RELABL44	1838
150	IJ=IJ+1	RELABL45	1839
	IDIS(IA)=L	RELABL46	1840
	KO=KO+1	RELABL47	1841
	IAJ(IJ)=IA	RELABL48	1842
	IW(IJ)=IDEG(IA)	RELABL49	1843
200	CONTINUE	RELABL50	1844
	IF(IJ-1)250,210,220	RELABL51	1845
210	J=KO	RELABL52	1846
	IZ=IAJ(1)	RELABL53	1847
	NEW(KO)=IZ	RELABL54	1848
	ILD(IZ)=KO	RELABL55	1849
	GO TO 250	RELABL56	1850
220	X=0	RELABL57	1851
221	DO 230 I=2,IJ	RELABL58	1852
	IF(IW(I)-IW(I-1))224,230,230	RELABL59	1853
224	CONTINUE	RELABL60	1854
	X=IW(I)	RELABL61	1855
	IW(I)=IW(I-1)	RELABL62	1856
	IW(I-1)=X	RELABL63	1857
225	X=IAJ(I)	RELABL64	1858
	IAJ(I)=IAJ(I-1)	RELABL65	1859
	IAJ(I-1)=X	RELABL66	1860
230	CONTINUE	RELABL67	1861
	IF(X)235,235,220	RELABL68	1862
235	DO 240 I=1,IJ	RELABL69	1863
	J=J+1	RELABL70	1864
	IZ=IAJ(I)	RELABL71	1865
	NEW(J)=IZ	RELABL72	1866
	ILD(IZ)=J	RELABL73	1867
240	CONTINUE	RELABL74	1868
250	IF(KO>NNC)130,255,255	RELABL75	1869
255	CONTINUE	RELABL76	1870
	RETURN	RELABL77	1871
	END	RELABL78	1872
	FUNCTION IDIST(NS,ML,MAXLEV,IG,II1,IC,IDEG,IDIS,IW,ICC)	IDIST 2	1873
C	THIS FUNCTION HAS AS ITS VALUE THE MAXIMUM DISTANCE OF ANY NODE	IDIST 3	1874
C	IN COMPONENT IC(NS) FROM THE NODE NS.	IDIST 4	1875
C	THE DISTANCE OF EACH NODE IN THIS COMPONENT IS STORED IN THE ARRAY	IDIST 5	1876
C	IDIS.	IDIST 6	1877
C	THE MAXIMUM NUMBER OF NODES AT THE SAME DISTANCE FROM NS IS	IDIST 7	1878
C	STORED IN ML.	IDIST 8	1879
	DIMENSION IG(II1,1),IC(1),IDEG(1),IDIS(1),IW(1),ICC(1)	IDIST 9	1880
	COMMON /S/ NN,MM,IH,IB	IDIST 10	1881
	COMMON /A/ MAXGRD	IDIST 11	1882
	COMMON /BITS/ NBITIN,NBITEX,IPASS	IDIST 12	1883
	ICN=IC(NS)	IDIST 13	1884
	NNC=ICC(ICN+1)-ICC(ICN)	IDIST 14	1885
	DO 50 I=1,NN	IDIST 15	1886
	IF(IC(I)-IC(NS)) 50,40,50	IDIST 16	1887
40	IDIS(I)=0	IDIST 17	1888
50	CONTINUE	IDIST 18	1889
	LL=1	IDIST 19	1890
	L=0	IDIST 20	1891
	KI=0	IDIST 21	1892
	KO=1	IDIST 22	1893
	ML=0	IDIST 23	1894
	IW(1)=NS	IDIST 24	1895
	IDIS(NS)=-1	IDIST 25	1896
130	KI=KI+1	IDIST 26	1897
	IF(KI-LL)135,132,135	IDIST 27	1898
132	L=L+1	IDIST 28	1899
	LL=KO+1	IDIST 29	1900

```

      K=KO-KI+1
      IF(K-ML) 135,135,133
133  ML=K
      IF(ML-MAXLEV) 135,135,220
135  II=IW(KI)
      N=IDEG(II)
      IF(N)140,215,140
140  DO 200 I=1,N
      IA = IG(II,I)
      IF(IDIS(IA))200,150,200
150  IDIS(IA)=L
      KO=KO+1
      IW(KO)=IA
200  CONTINUE
      IF(KO-NNC)130,205,205
205  IDIST=L
      IDIS(NS)=J
      K=KO-KI
      IF(K-ML) 206,206,207
207  ML=K
206  CONTINUE
      RETURN
215  L=0
      GO TO 205
220  IDIST=1
      RETURN
      END
      SUBROUTINE REMARK(A)
      RETURN
      END
      FUNCTION EOF(I)
      INTEGER EOF
      EOF=0
      RETURN
      END

```

```

IDIST 30      1901
IDIST 31      1902
IDIST 32      1903
IDIST 33      1904
IDIST 34      1905
IDIST 35      1906
IDIST 36      1907
IDIST 37      1908
JJ      47      1909
IDIST 39      1910
IDIST 40      1911
IDIST 41      1912
IDIST 42      1913
IDIST 43      1914
IDIST 44      1915
IDIST 45      1916
IDIST 46      1917
IDIST 47      1918
IDIST 48      1919
IDIST 49      1920
IDIST 50      1921
IDIST 51      1922
IDIST 52      1923
IDIST 53      1924
IDIST 54      1925
IDIST 55      1926
IDIST 56      1927
JJ      48      1928
JJ      49      1929
JJ      50      1930
JJ      51      1931
JJ      52      1932
JJ      53      1933
JJ      54      1934
JJ      55      1935

```

INITIAL DISTRIBUTION

Copies

1 DNL
 1 CNO
 4 ONR
 1 N. Basdekas
 1 N. Perrone
 1 S. Brodsky
 1 R.J. Lundegard
 1 ONR Chicago
 1 R.N. Buchal
 4 NRL
 1 D. Curtis
 1 R. Perlut
 1 R.W. Alvarez
 1 Lib
 1 NAVMATCOMHQ
 1 Mrs. S. Atchison
 2 CDR, NAVORDSYSCOM
 1 O. Seidman
 1 Lib
 3 NAVSHIPSYSYSCOMHQ
 1 Dr. J.H. Huth
 1 R.R. Kolesar
 1 Tech Lib
 2 CO, NAVAIRDEVCCEN
 1 A. Somoroff
 1 Lib
 2 CO, NAVCIVENGRLAB
 1 J. Crawford
 1 Lib
 2 CDR, NELC
 1 E. Nissan
 1 Tech Lib
 1 CDR, NAVOCEANO
 1 Tech Lib

Copies

6 CDR, NOL
 1 R.J. Edwards
 1 W.A. Walker
 1 J.F. Goeller
 1 W. Wassmann
 1 E.P. Johnson
 1 Tech Lib
 1 CO, NSSNF
 1 Tech Lib
 1 CO, NAVTRADEVCCEN
 2 NAVUSEARANDCEN HAWAII
 1 A.T. Strickland
 1 Lib
 2 NAVUSEARANDCEN PASADENA
 1 C.F. Falkenback
 1 Lib
 4 NAVUSEARANDCEN SAN DIEGO
 1 J.T. Hunt
 1 L. McCleary
 1 D. Barach
 1 Lib
 1 NUSC NEWPT
 4 NUSC NLON
 1 A. Carlson
 1 R. Manstan
 1 J.W. Frye
 1 R. Dunham
 4 CDR, NAVWPNSCEN
 1 J. Serpanos
 1 D.E. Zilmer
 1 W.J. Stronge
 1 Tech Lib
 4 CDR, NAVWPNSLAB
 1 C.M. Blackmon
 1 J. Schwartz
 1 P. Johnson
 1 Tech Lib

Copies

3 SUPT, USNA
 1 Dept of Math
 1 Aerospace Dept
 1 Tech Lib
 1 SUPT, PGSCHOL, Monterey
 1 Lib, Tech Reports Sec
 1 ROTC & NAVADMINU MIT
 1 Naval War College
 5 CDR, NAVSEC
 1 N. Griest
 1 R. P. Lavoie
 1 G. J. Snyder
 1 T. W. Hull
 1 Tech Lib
 2 CDR, NAVAIRSYSCOMHQ
 1 G. P. Maggos
 1 Tech Lib
 4 CDR, NAVFACENGCOMHQ
 1 M. Yachnis
 1 H. D. Nickerson
 1 M. B. Hermann
 1 Tech Lib
 2 CO, NAVAIRENGCEN
 1 T. Mazella
 1 Tech Lib
 1 CO, NAVAERORECOVFAC
 1 CO, NAVAIRPROPTTESTCEN
 1 CDR, NAVAIRTESTCEN
 1 Tech Lib
 1 CO, NAVAIRTESTFAC
 1 Naval Avionics Facility
 Indianapolis
 1 S. Stephen
 1 CO, NAVEODFAC
 1 CO, NAVORDMISTESTFAC
 1 Tech Lib

Copies

1 CO, NAVORDTESTU
 1 NAVSHIPYD BREM
 1 NAVSHIPYD BSN
 2 NAVSHIPYD CHASN
 1 J. B. Kruse
 1 NAVSHIPYD HUNTERS PT
 1 NAVSHIPYD LBEACH
 2 NAVSHIPYD MARE ISLAND
 1 W. Richardson
 1 NAVSHIPYD NORVA
 1 NAVSHIPYD PEARL
 1 NAVSHIPYD PHILA
 2 NAVSHIPYD PTSMH
 1 E. A. Fernald
 1 CO, NAVSPASYSACT
 1 NAVWPNSENGSUPTACT
 1 CO, NAVWPNEVALFAC
 1 CDR, PACMISTRAN
 1 CDR, NAVMISCEN
 1 Tech Lib
 2 DIA, Washington, D. C. 20301
 1 K. Goering
 1 R. Wood
 4 US ARMY, Harry Diamond Labs.
 1 J. Miller
 1 G. J. Hutchins
 1 P. J. Emmerman
 1 C. Anstine, Jr.
 12 DDC

Copies

- 1 US Army Electronics
Command, Fort Monmouth
New Jersey 07703
1 A. L. Sigismondi
- 5 USCOGARDHQ
1 W. A. Cleary
1 R. Johnson
1 LCDR V. F. Keith
1 LTjg M. C. Grosteck
1 LT J. C. Card
- 5 USAMERDC
1 H. G. Schaeffer
1 J. Marburger
1 R. W. Helmke
1 C. L. Orth
1 J. McDonald
- 5 NASA Greenbelt
1 J. Mason
1 W. Case
1 T. G. Butler
1 R. Courtney
1 W. H. Browne, Jr.
- 4 NASA Langley Field
1 J. P. Raney
1 D. Weidman
1 J. H. Starnes, Jr.
1 O. U. Storaasli
- 1 NASA Ames
1 P. R. Wilcox
- 1 NASA Huntsville
1 S. M. Seltzer
- 5 ORL, Penn State
1 J. C. Conway
1 J. Kiusalass
1 J. W. Sharer
1 A. L. Stiehl
1 Lib

Copies

- 1 JHU/APL
1 W. Caywood
1 G. Dailey
1 R. M. Rivello
1 J. S. O'Connor
- 1 University of Maryland
1 Library
- 1 Mr. T. M. Olsen
Teledyne Isotopes
Energy Systems Division
110 W. Timonium Road
Lutherville, Maryland 21093
- 1 Mr. S. D. Hansen
The Boeing Company
Renton, Washington
- 1 Mr. Charles L. Blackburn
AVCO Aerostructures Div.
Nashville, Tennessee
- 1 Mr. Walter Tonelli
Convair Div. of General
Dynamics, Kearny Villa Plant
Dept. 622-4
San Diego, California 92112
- 1 Dr. Robert H. Mallett
Advanced Reactor Div.
Westinghouse Electric Corp.
P. O. Box 158
Madison, Pennsylvania 15663

Copies

- 1 Dr. E. G. Baker
American Bureau of Shipping
45 Broad Street
New York, N. Y. 10004
- 1 Mr. R. B. Morgan
Texas Instruments, Inc.
P. O. Box 5012, MS 3
Dallas, Texas 75222
- 1 Mr. W. L. Cook
Room 6097
Communications Satellite Corp.
950 L'Enfant Plaza, S.W.
Washington, D. C. 20006
- 1 Mrs. P. L. Anderson
Advanced Analytical Tech Dept
Ford Motor Company
23400 Michigan Ave
Dearborn, Michigan 48124
- 1 Mr. C. Gerber
Dept. K678
McDonnell-Douglas Automation Co.
Box 516
St. Louis, Mo. 63166
- 1 Mr. R. Hopkins
Hercules, Inc.
Salt Lake City, Utah
- 1 Dr. Martin Goldberg
208 Violet Street
Massapequa Park, N. Y. 11762
- 1 Dr. R. H. MacNeal
MacNeal-Schwendler Corp.
7442 N. Figueroa Street
Los Angeles, Calif. 90041
- 1 Mr. W. S. Viall
Teledyne Brown Engr. Co., Inc.
Huntsville, Alabama

Copies

- 1 Dr. Richard Eppink
Civil Engineering Dept.
University of Virginia
Charlottesville, Va. 22901
- 1 Mr. Michael Hirtle
Aerospace Engineering Dept.
University of Maryland
College Park, Md. 20742
- 1 Mr. M. Pakstys
EB Div., Gen Dyn Corp.
Groton, Connecticut 06340
- 1 Dr. Roy Levy
Jet Propulsion Lab.
Calif. Inst. of Technology
Pasadena, Calif. 91103
- 1 Mr. P. R. Spencer (43-50)
Rm. 5130, Nassif Bldg.
National Highway Traffic
Safety Admin.
400-7th Street, S.W.
Washington, D. C. 20590
- 1 Mr. G. P. O'Hara
Applied Math. & Mech. Div.
Bldg. 124
Watervliet Arsenal
Watervliet, N. Y. 12189
- 1 Mr. R. K. Gieseke
Convair Aero. Div. of Gen Dyn
San Diego, California
- 1 Mr. Ronald P. Schmitz
Space Support Division
Sperry Rand Corp.
Huntsville, Alabama

CENTER DISTRIBUTION

Copies	Code	Copies	Code
1	01	1	1854
1	11 W.M. Ellsworth	1	19 P.S. Dell Aria
1	15 Dr. W.E. Cummins	1	194
1	16 Dr. H.R. Chaplin	1	196
1	17 Dr. W.W. Murray	1	1962
1	172	1	27 H.V. Nutt
1	1721	1	271
1	1725	1	272
1	1727	1	273
1	173	1	2731
1	1731	1	274
1	1735	1	2741
1	174	1	2742
1	1745	1	275
1	177 (UERD PTSMH)	1	276
1	177B (UERD PTSMH)	1	28 D.H. Kallas
1	1775 (UERD PTSMH)	1	287
1	18 G. Gleissner	1	94 J.L. Decker
1	1805	1	9424 Dr. M.E. Lunchick
1	184	1	5641
1	1842	1	5642
100	1844	1	5643
1	185	1	5644
1	1852		
1	1853		

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R & D		
<i>(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)</i>		
1. ORIGINATING ACTIVITY (Corporate author) Naval Ship R&D Center Bethesda, Maryland 20034		2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED
		2b. GROUP
3. REPORT TITLE The BANDIT Computer Program for the Reduction of Matrix Bandwidth for NASTRAN		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Research and Development Report		
5. AUTHOR(S) (First name, middle initial, last name) Gordon C. Everstine		
6. REPORT DATE March 1972	7a. TOTAL NO. OF PAGES 74	7b. NO. OF REFS 4
8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S) Report 3827	
b. PROJECT NO. ZR 0140201		
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
d.		
10. DISTRIBUTION STATEMENT Approved for public release; distribution unlimited.		
11. SUPPLEMENTARY NOTES		12. SPONSORING MILITARY ACTIVITY Naval Ship R&D Center Technical Director Bethesda, Maryland 20034
13. ABSTRACT This report describes a matrix bandwidth reduction preprocessor for use with the NASA structural analysis computer program, NASTRAN. Called BANDIT, the program is written in FORTRAN and uses the Cuthill-McKee strategy for resequencing grid points. Versions of the program for both CDC and other computers are presented.		

UNCLASSIFIED

Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
NASTRAN Finite Element Analysis Matrix Methods Bandwidth Reduction BANDIT Matrix Bandwidth Reduction Structural Analysis-Computer Methods						